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CHRONIC ADHESIVE SUBACROMIAL BURSITIS*

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THE purpose of this paper is to discuss the management of patients who exhibit loss of function of an upper extremity due to pronounced limitation of shoulder-joint motion, which in turn is the result of chronic adhesive subacromial bursitis, most commonly referred to by the term "frozen shoulder." In our experience, this is a most disabling condition and relatively resistant to treatment.

Review of the Literature

Since the publication by Codman[1] of his basic text, *The Shoulder*, in 1934, medical journals have presented a voluminous literature on shoulder disabilities in relation to the subacromial bursa. Comparatively little attention, however, has been paid to the adhesive type of subacromial bursitis, possibly because the diagnosis is often not clearly established. As Ferguson[2] states in his excellent five-year review of the literature on the subject of shoulder disability: "In cases of acute bursitis and of complete ruptures of the supraspinatus tendon the clinical picture is fairly clear cut and the therapy usually successful. In the other lesions the differential diagnosis is somewhat more difficult for the reason that several of them may be combined or follow one another, so that the history is by no means clear and the findings may fit into several diagnoses." Bennett[3] and Solomon,[4] writing under the term "periarthritis," discuss the condition. The former author describes the pathology when he states that "fibrous tissue proliferation takes place in the periarticular tissue, with hypertrophy of the synovial folds, and inflammatory exudate within the various adjacent bursae has resulted in formation of adhesions within the bursae." He likewise adds that "the muscles surrounding and supporting the region, having been kept in a state of protracted spasm, have become contracted as a result of lessened elasticity and invasion of fibrous and fatty tissue in and around the muscle bundles." Both Bennett and Solomon believe in physical therapy with heat, gradually increasing massage, together with bed rest, abduction and traction, and in some cases manipulation. In 1935, one of us (G. E. H.)[5] noted that the adhesive type of bursitis was extremely difficult to treat and seemed to be best managed by progressive manipulation and the use of abduction and traction in resistant cases.

We have most frequently observed chronic adhesive subacromial bursitis with or without calcification in the fifth and sixth decades, which forms interesting comparison with the finding of Bosworth[6] of a large number of patients in the young and middle-age group who exhibited calcium deposits in roentgenograms of the shoulder. This survey comprised a study of both shoulders of 6061 normal persons. Of this number, 165 subjects (2.7 per cent) revealed calcific deposits in one or both shoulders.

Anatomy and Pathology

For the present-day concept of the anatomy of the subacromial bursa and the conditions affecting it, much credit is owing to Codman,[1] first, on the basis of his articles, and secondly, on that of his book. To any of the younger men interested in shoulder disability who may not have read the latter, we strongly recommend that they do so at the first opportunity. Figure 1, reproduced from one of Codman's early papers, together with Figures 2 and 3, exhibit the anatomy of the subacromial bursa and the musculature of the adjacent shoulder joint. In adhesive bursitis there is atrophy of the shoulder muscles together with degenerative change and scar-tissue formation in the capsule and tendons about the shoulder joint. We believe that the basic factor causing this disability is the presence of adhesions between the

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floor and roof of the subacromial bursa, and consequent loss of the gliding function normally present there. Instead, scapulothoracic motion results,

FIGURE 1. *Diagrammatic Representation of a Coronal Section of the Shoulder Joint.*

This shows the relation of the subacromial bursa to the adjacent bone and muscle structures (reproduced from Codman[2]). A is the acromial process, and B, the great tuberosity of the humerus. In a the arm is dependent at the side of the body, whereas in b it is slightly beyond horizontal abduction.

as pointed out by Codman, with consequent restriction of the normal range of motion at the shoulder joint.

Although these patients frequently exhibit neuritic symptoms, especially pain radiating down the upper extremity and up into the neck and back of the shoulder, the symptoms are not the result of a true neuritis, a term so frequently employed, but of the bursitis. Lack of an understanding of this basic etiology has been responsible for much ineffectual treatment.

CLINICAL FINDINGS

A patient with chronic adhesive subacromial bursitis seeks medical advice for persistent pain in the shoulder, oftentimes extending up into the neck as well as down the arm into the hand, marked loss of shoulder-joint function, or both. Not infrequently the latter complaint is the only cause of disability. Pain may have been of long duration, but by the time the patient is seen in consultation the pain has often largely disappeared, leaving the shoulder with marked limitation of motion.

Depending on the duration of symptoms, the patient reveals atrophy of the musculature of the shoulder region, to a greater or less degree. It is sometimes pronounced. Furthermore, some patients also complain of pronounced loss of finger joint function (Fig. 4). The hand is swollen and is similar in appearance to that seen in atrophic arthritis. In all our patients with this complication, the finger joints of the affected extremity were the only articulations that exhibited these changes, and therefore there was no question of a generalized rheumatoid arthritis.

The particular shoulder motion lost is that of external rotation and lateral abduction. Anteroposterior motion is usually of almost normal range. The patient can rotate the arm internally so that the forearm lies across the front of the body, but he can rarely pass the hand behind the low back or even place the hand on the hip.

Although local points of tenderness over the shoulder are present, they are less acute and less well localized than those exhibited by patients suffering from an acute subacromial bursitis with calcification. In patients with calcification and adhesive bursitis, local tenderness is more accurately defined. When requested to abduct the arm, the patient performs this motion by a combination of scapulothoracic motion and lifting the entire shoulder high on the affected side while the opposite shoulder is depressed (Fig. 5). On passive motion, assuming that the patient can be persuaded to relax, the humerus is abducted laterally from the side of the body, on the average 15 to 20°, at which point the scapula starts to move toward the axilla. If the scapula is held firmly, further passive or active lateral abduction of the arm is not possible.

The roentgenograms of the shoulder of a patient with chronic adhesive subacromial bursitis consistently reveal generalized atrophy of the bones of the shoulder girdle (Fig. 6), and in some cases this degree of decalcification of bone is pro-

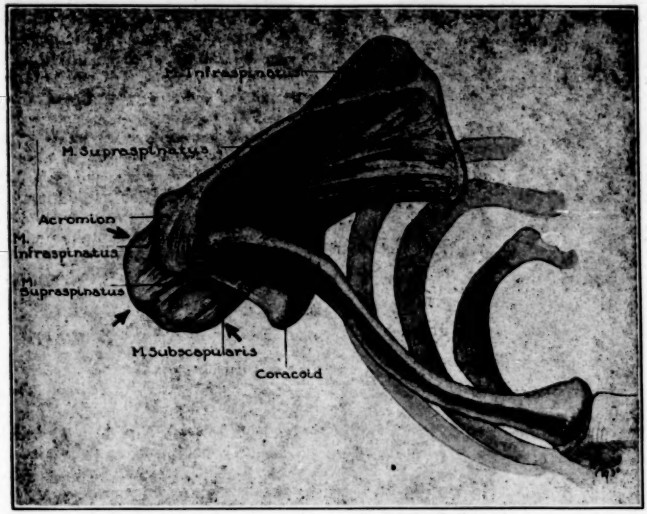

FIGURE 2. *Anatomical Drawing Made from a Dissected Specimen, Looking Down on the Shoulder from Above.*

This shows the origin and insertion of the short rotator muscles and their relation to the acromioclavicular joint. The subacromial bursa lies superior to these muscles, as shown in Figure 1.

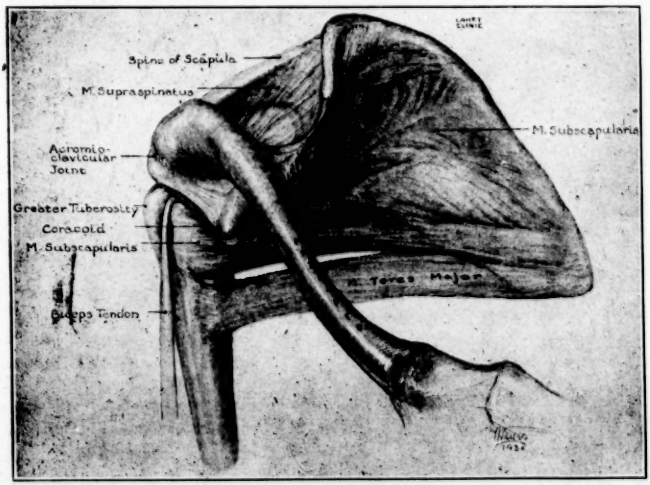

FIGURE 3. *Section of the Shoulder-Joint Region from Above and Anteromedially. This further illustrates the anatomy of the region.*

nounced. In these patients, open operation and lysis of the adhesions are often advised, as well

FIGURE 4. *Hands Disabled by a Pronounced Chronic Adhesive Left Subacromial Bursitis.*

Note the generalized swelling of the left hand and the shiny, tense skin. The general appearance is similar to that of an acute atrophic arthritis. There was marked loss of finger-joint function.

tendons, usually the supraspinatus. If a tendon injury is present, it occurs together with a subacromial bursitis in patients who give a definite history of trauma, a comparatively severe injury initiating the onset of shoulder pain, and thereafter gradual and progressive loss of shoulder-joint motion. The majority of patients with adhesive subacromial bursitis give no history of trauma as an etiologic factor, or the type of injury described is one that is hardly severe enough to have caused rupture of one of the short rotator tendons.

In our experience, foci of infection, such as abscessed teeth, chronic tonsillitis, chronic sinus infection and prostatitis, have not been of significance in the treatment of these patients. On the basis of good hygiene, such foci should be treated, but the results from elimination of foci of infection have not been encouraging.

Adhesive bursitis often results from some general systemic situation that forbids shoulder-joint function. The most notable examples are found in diseases of the central nervous system, such as hemiplegia, as reported by Dynes.[8] We have also observed marked loss of shoulder-joint function due to an adhesive bursitis that developed following a bilateral cataract operation, apparently the result of the patient's immobility in bed over a considerable period of time.

TREATMENT

The management of patients with chronic adhesive subacromial bursitis, with or without calcification, follows. No originality is claimed for

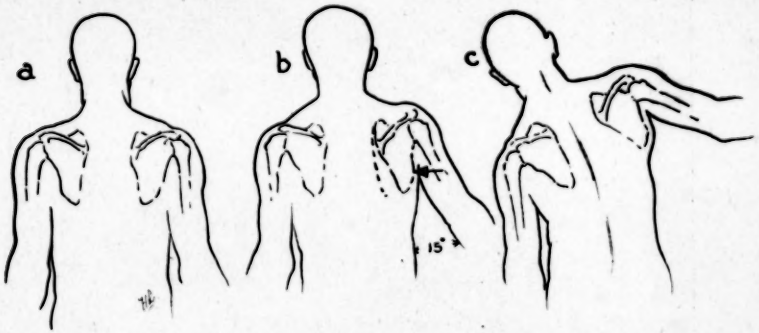

FIGURE 5. *Diagrammatic Illustration of the Method by Which a Patient with Chronic Adhesive Subacromial Bursitis Raises the Arm from the Side of the Body.*

Abduction does not occur in the shoulder joint, but instead is accomplished by a combination of scapulothoracic motion and elevation of the affected shoulder.

as the usual manipulative procedures, to prevent fracture of the humerus.

In occasional cases,—and these are relatively rare,—there is a tear in one of the short rotator

this therapy, since unquestionably part or all of it has been previously utilized by other surgeons. This plan of treatment is presented, however, as an effective means of relieving pain and eventually

FIGURE 6. *Anteroposterior Roentgenograms of the Shoulder.*

The photograph on the left is of a patient with a normal shoulder; that on the right of a patient with long-standing chronic adhesive subacromial bursitis. Note the pronounced degree of atrophy of the bones of the shoulder girdle.

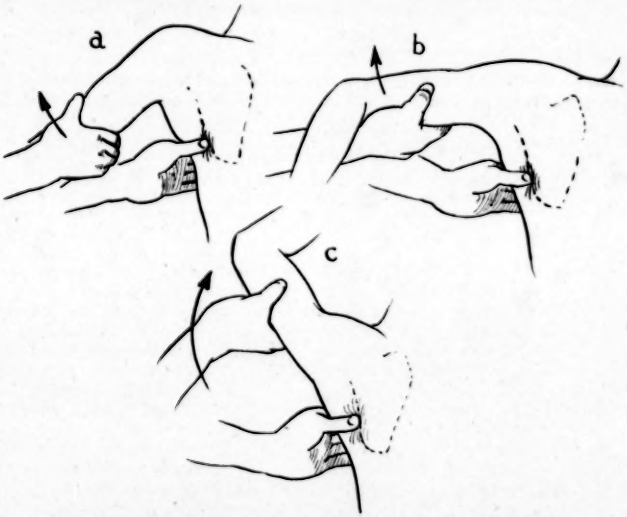

FIGURE 7. *Manipulative Treatment of Chronic Adhesive Subacromial Bursitis.*

These maneuvers are designed to increase the range of lateral abduction. Note that the scapula is held firmly to prevent scapulothoracic motion. The scapula normally begins to move toward the axilla only after the arm has passed the horizontal plane.

restoring normal shoulder function in this difficult group of cases.

When the patient is first seen, it is particularly important that he clearly understand the basis of his disability, as well as the fact that it will require a minimum of three to four and occasionally as long as twelve to sixteen months to restore normal function of the shoulder. The actual extent of treatment and active supervision of the case will obviously depend on many factors, such as the initial degree of limitation of shoulder function, the extent of muscle weakness and atrophy, the previous duration of symptoms and, especially, the patient's willingness to co-operate in the program outlined. The duration of treatment is emphasized because repeatedly patients who have had ade-

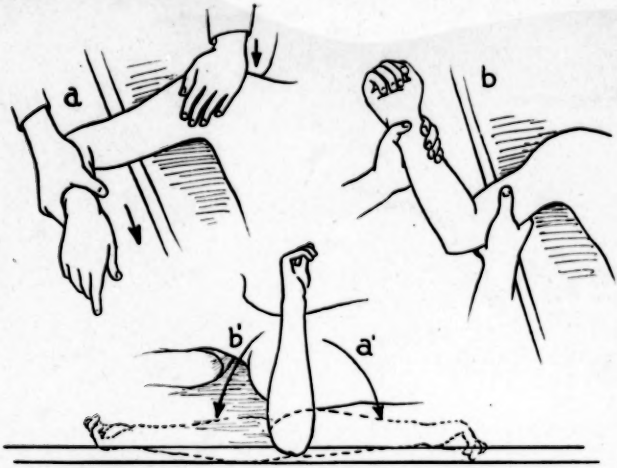

FIGURE 8. *Manipulative Treatment to Obtain External and Internal Rotation.*

As described in the text, these maneuvers are always done under general anesthesia, preferably intravenous Pentothal Sodium.

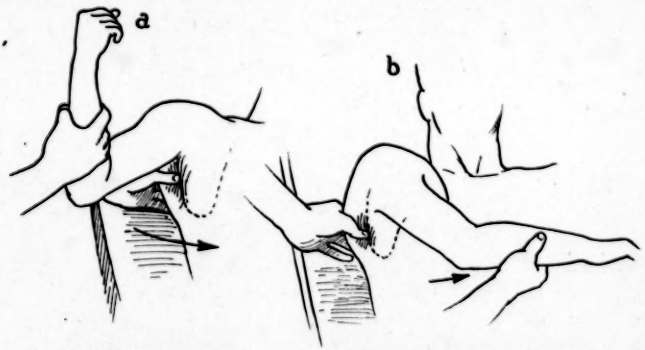

FIGURE 9. *Manipulative Treatment of Chronic Adhesive Subacromial Bursitis.*

This is designed to increase the range of adduction of the arm at the shoulder joint. Here again, immobilization of the scapula is necessary.

quate therapy elsewhere but who did not realize the long period required to obtain normal function of the shoulder have become discouraged, have discontinued treatment, and have then sought advice from other physicians.

The patient also must understand clearly the significant role played by adequate and well-directed physiotherapy. We particularly refer to progressive, active exercises of the shoulder musculature, carried out under the direction of a competent physiotherapist. This part of the treatment is performed at home by the patient, following initial training either in the clinic or in the hospital. Without exception all the patients with an adhesive bursitis require this phase of treatment.

On admission a patient with chronic adhesive subacromial bursitis is given the usual general examination, with particular reference to the local findings in the shoulder. Roentgenograms are taken and an analysis of the case is made. If the degree of limitation of motion is marked and the patient suffers considerable pain, he is advised to enter the hospital, since this permits much more rapid progress, not the least effect of which is the pronounced improvement in mental attitude.

Where considerable limitation of motion and marked discomfort exist, the patient is put to bed and the arm suspended in a Balkan-frame apparatus, with — and this is significant — the extremity in the maximum degree of abduction that does not cause increased discomfort. Then adhesive traction, averaging 6 to 8 pounds, is applied to the upper arm, utilizing the Blake board. Intensive local heat repeatedly applied to the shoulder is instituted, together with massage. The patient is encouraged to move the arm in the apparatus as much as he can comfortably do so. Every effort is made to achieve general relaxation, to make the patient sleep well, and in general to establish the maximum degree of comfort possible under the circumstances. Such a phase may require as long as a week, but is oftener a matter of three to five days.

With the patient well adjusted to his apparatus, intensive active exercises of the shoulder are instituted. We have repeatedly observed that on this simple program the range of active and, in

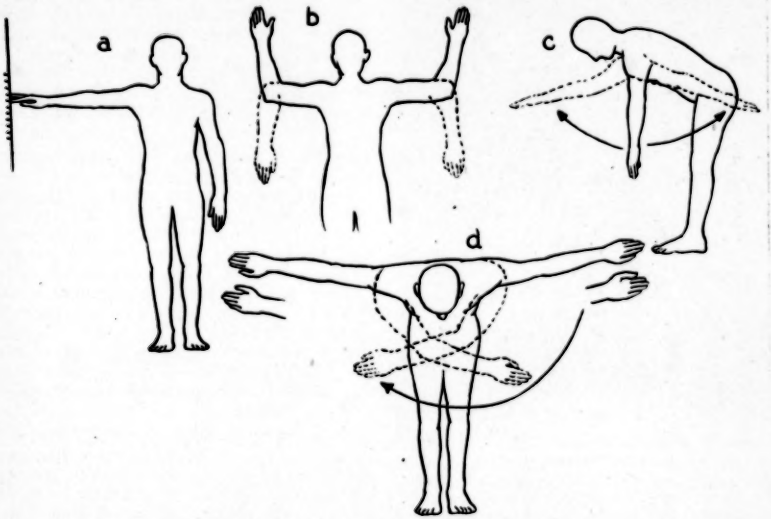

FIGURE 10. *Diagrams of Exercises.*

These are important in the ambulatory stage of the treatment of chronic adhesive subacromial bursitis. Note that the pendulum type of exercise permits what amounts to normal range of shoulder-joint motion without the effect of gravity and hence with a minimum degree of effort and discomfort.

particular, of passive abduction is increased as much as 30 to 40° in seven to ten days. When the patient has reached a maximum amount of improvement, as judged by his ability to abduct the arm, a shoulder-joint manipulation is carried

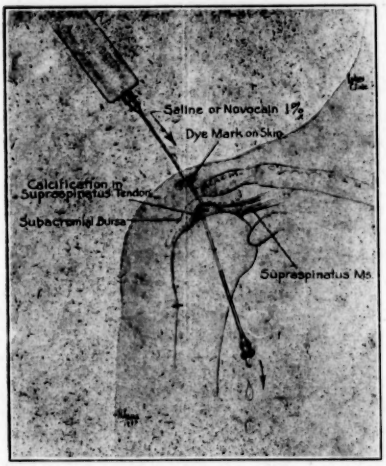

FIGURE 11. *Removal of Calcified Deposits in the Tendon of the Supraspinatus Muscle.*

This is accomplished by the "washing out" technic (Smith-Petersen[11]). The dark area on the skin through which the superior needle has passed to enter the calcified deposit indicates the site of maximum tenderness on palpation. Localization by intermittent fluoroscopy permits accurate needling and washing out of the calcific material.

out under intravenous Pentothal Sodium anesthesia in the patient's room, with the arm in the apparatus.

Figures 7, 8 and 9 show the significant maneuvers in the actual manipulation. It should be noted that the scapula must be immobilized by one hand of the operator, while the other grasps the upper end of the humerus. In progressive stages the arm is moved laterally in abduction, during which maneuver numerous adhesions will be felt and heard to rupture. The significance of grasping the upper end of the humerus lies in the fact that this reduces the leverage action on that bone and hence it is less likely to fracture. No attempt is made to obtain a normal range of motion in the first manipulative procedure, because if this were done, frequently the resulting pain and discomfort would be so great that the patient would be unable to move the arm through the arc of motion that was present before the procedure. So in progressive stages the range of motion, both of lateral abduction and of rotation, is gradually increased. The actual extent of the manipulation is learned by experience, but a safe rule is to carry the arm through a lesser rather than a greater degree of motion.

With the manipulation completed, 1 per cent novocain is injected into the subacromial bursa, as well as into the periarticular structures of the shoulder joint. This idea, originally suggested by the work of Leriche and Policard[9] in their treatment of sprains, has been of considerable aid in reducing the degree of discomfort that may follow the manipulation.

During the twenty-four hours after manipulation, no particular effort is made to have the patient move his arm unless he feels like doing so, but the intensive heat treatment is continued and sedatives are given as required to control discomfort. Beginning with the second postoperative day, active arm exercises are again instituted, in an attempt to increase the range of lateral abduction and of rotation. In practically every case the patient finds that he is able to move the arm through a wider arc of motion than was previously possible. Thereafter, the regimen as described is continued until further manipulation is indicated; this is performed after the patient again has reached a maximum degree of improvement.

As soon as the pain in the shoulder is less severe, the traction on the arm is progressively omitted, thus permitting much more active motion of the extremity. The patient then becomes ambulatory and begins pendulum exercises (Fig. 10), which are especially advantageous since the effect of gravity is eliminated and the patient can obtain normal motion at the shoulder joint with a minimum of effort. Likewise, in this same position the degree of pain caused by motion is considerably reduced.

In the ambulatory stage, the patient is discharged from the hospital and carries on his exercises at home, coming into the clinic on an average of two or three times a week for further physiotherapy, such as a combination of inductotherm, infrared radiation and massage, but always the main emphasis is placed on progressive active muscle exercises.

Thereafter the decision regarding further treatment depends on the patient's progress. If he is remiss in carrying out the active exercises and the adhesions recur, this negligence is emphasized, and he may then be readmitted for a few days in the hospital for further manipulative treatment. In the co-operative patient who continues under observation, however, this is usually unnecessary.

A patient who lives at a distance is referred to his physician, and every effort is made to have him carry on treatment under the latter's active supervision.

In treatment of chronic adhesive subacromial bursitis with calcification in the bursa or in the tendon of the short rotator muscles, the foregoing program is also instituted with the following additions. The initial manipulation is done on the fluoroscopic table, again under intravenous Pentothal Sodium anesthesia. Needles are passed into the area of the calcification (Fig. 11), and as described in the article by Patterson,[10] the technic of Smith-Petersen[11] is attempted — namely, the washing out of the calcified material. Before we were aware of this particular procedure, our practice had been to pierce the calcified deposit repeatedly with needles and inject novocain. This maneuver alone seems to encourage more rapid disappearance of the calcified deposit, but the washing-out technic has proved most efficacious.

Open Operation

In one other group of patients, which includes two types, open operation is resorted to.

The most commonly encountered patient in this group is the one in whom the adhesions are so resistant to manipulative procedure that it is considered unwise to rupture them. The bursa is therefore explored (Fig. 12) and many of the adhesions are divided with a knife, and thereafter the usual manipulative maneuvers are performed. It should be emphasized that the decision to open a bursa of this type is made because of the dense, firm adhesions in the presence of extensive bone atrophy. In such a patient the manipulations may well cause fracture of the shaft of the humerus. This possibility is eliminated by open operation, since a considerable number of adhesions are divided and those that remain in the less accessible part of the bursa can be ruptured by manipulation without fear of humeral fracture.

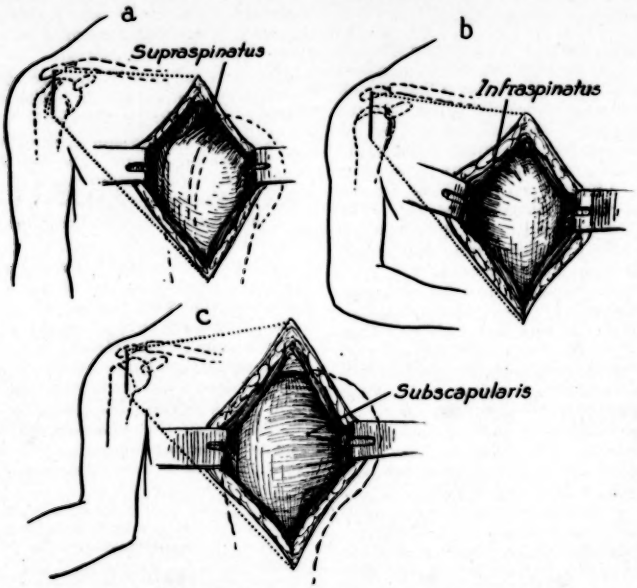

FIGURE 12. *Tendons of the Shoulder Joint.*

Through a small incision and with rotation of the arm, visualization not only of the subacromial bursa but also of the underlying tendons of the short rotator muscles is possible. The diagrams exhibit the tendons shown by the corresponding position of the arm.

The other type of operative case is the one with a large mass of calcification that we have not succeeded in removing by the needling technic. Here the subacromial bursa is explored, and the calcified deposit as it lies in the tendon is incised and curetted out as described by Codman.

Statistics and Results

The data presented in this paper are based on an analysis of the treatment of 100 consecutive patients admitted to the Lahey Clinic because of chronic adhesive subacromial bursitis. Of this number, 9 patients, although improved on discharge, have not had an adequate follow-up for evaluation of the end results. Forty patients have been followed for over two years, 27 for over one year, and 14 for six months to one year. In 10 cases the follow-up was less than six months, but the results were so satisfactory that it was thought that an end result could be reported.

These 100 patients were divided into five groups. Those in Group A (47 cases) — were completely relieved of all symptoms and disability. Those in Group B (34 cases) were markedly improved. They had no disability and acknowledged only occasional pain. All the patients in Groups A and B returned to their previous occupations, and their ability to carry out these activities was in no way impaired. The patients in Group C (5 cases) were followed from six months to two years. All of them exhibited improvement but not enough to be classified in either Group A or B. Each of these 5 patients had either normal motion and some discomfort, or better than 50 per cent normal shoulder motion and no pain. The patients in Group D (5 cases) were unimproved. Those in Group E (9 cases) were improved on discharge, but the follow-up was inadequate.

Of 100 patients, therefore, the majority of whom were followed a minimum of six months and in most cases over a year, 81 either were relieved completely of all symptoms or were markedly improved and remained without any disability, although they occasionally complained of some shoulder discomfort.

Summary and Conclusions

In summarizing the treatment of this difficult problem, we wish to emphasize the following significant points:

The patient should be forewarned regarding the basis for his disability and the considerable length of time that is often required to achieve a return of normal shoulder-joint function, as well as the absolute necessity for his complete co-operation in carrying out the often extremely fatiguing and boring exercises.

An initial period of bed rest, the arm in suspension and traction, usually results in marked increase of shoulder-joint function.

Manipulative procedures designed to break up the adhesions in the bursa and about the soft parts in the shoulder should be done in stages, and no attempt should be made to obtain normal motion in the shoulder at the first manipulation.

In the case of extremely resistant adhesions, especially when present in frail, poorly muscled patients who have had the loss of shoulder function for some time, with accompanying marked bone atrophy, it is preferable to explore the bursa, divide firm, fibrous bands, and eliminate the remaining adhesions by manipulation.

In chronic adhesive subacromial bursitis with calcification, the latter is removed by the washing-out technic or by open operation. Thereafter the regimen for patients without such deposits is carried out.

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A STUDY OF ERRORS IN THE DIAGNOSIS OF JAUNDICE*

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BOSTON

ON ward rounds and in clinicopathological conferences, cases with jaundice, especially those in the early stage, call forth a diversity of diagnoses and frequent mistakes. In the last six years 500 cases have come under our observation on the Second and Fourth (Harvard) Medical Services at the Boston City Hospital. These included most types of jaundice: complete and partial biliary obstruction, acute and subacute infectious and toxic hepatitis, the cirrhoses (portal, biliary, pigment, toxic and cardiac), fatty liver, tumors and syphilis of the liver and hemolytic jaundice. This paper is limited to 175 of these cases that came to operation or autopsy.

All known errors in diagnosis have been studied and classified. A statement of the number and kind of errors, showing which mistakes are commonest, may help to avoid them in the future. Errors are based on first-choice diagnoses only, and correct alternative diagnoses are not considered.

METHODS OF STUDY

In addition to a careful history and a general physical examination, special attention was paid to the size of the liver, spleen and gall bladder, the presence of ascites or spider angiomas, the icteric index, the color of the stool, tests for urinary diastase and the roentgenologic examination (Graham test, barium meals and enemas). Several liver-function tests were used in serial observations in each case, chosen from the following group: the excretion of urobilinogen and hippuric acid in the urine, galactose tolerance, excretion of bromsulfalein, the phospholipids, total cholesterol and cholesterol-ester percentage in the blood, the blood prothrombin level and its response to vitamin K, the serum albumin and the albumin-globulin ratio. In a small number of cases, peritoneoscopy and medical biliary drainage were used; biopsies of lymph nodes and liver were done when possible. A considerable number of the patients were followed and studied for months or years after the attack of jaundice in order to discover residual liver damage.

CLASSIFICATION

The cases were classified in four groups, as a guide to medical or surgical treatment: namely, complete biliary obstruction, partial biliary obstruction, hepatocellular jaundice‡ and hemolytic jaundice. McNee's[1] classification of jaundice was chosen as the most valuable clinical grouping, and obstruction was further divided, since it was found that complete obstructions were nearly all due to malignant neoplasms and partial obstructions were nearly all due to benign conditions. Rich's[2] classification into retention and regurgitation jaundice is important in showing the mechanism of jaundice, but has less clinical value than other classifications since there is rarely any difficulty in distinguishing these two types and since all the types of jaundice that are difficult to distinguish from one another are found in the regurgitation group.

The first two groups are essentially surgical with respect to treatment, and the last two essentially medical. The total group of 500 cases is listed in Table 1 to show the types. Almost one third of the cases were chronic cirrhosis; about one third were toxic and infectious hepatitis; and about one third formed a group including gall-bladder disease, complete obstruction, tumors and syphilis of the liver and hemolytic jaundice. There was a surprisingly large proportion of cases of jaundice

TABLE 1. *Cases of Jaundice Classified According to Type of Disease.*

TYPE OF DISEASE	PROVED CASES		TOTAL NO. OF CASES		PER CENT
Complete external obstruction:		29		33	6.6
Cancer of pancreas	20		24		
Cancer of common duct	6		6		
Cancer of hepatic ducts	2		2		
Stone in common duct	1		1		
Partial external obstruction:		61		93	18.6
Gallstones	39		71		
Stricture of common duct	5		5		
Acute pancreatitis	4		4		
Cancer of bile ducts, pancreas or duodenum	5		5		
Cholangitis and abscess	8		8		
Hepatocellular jaundice:		81		359	
Acute infectious hepatitis	9		101		20.2
Acute toxic hepatitis	2		41		8.2
Cirrhosis:	41		161		32.2
Portal	30	127			
Biliary	2	9			
Pigment	2	7			
Toxic	7	12			
Banti (?)	0	3			
Cardiac	0	3			
Fatty liver	1		9		1.8
Tumor of liver	27		46		9.2
Syphilis of liver	1		1		0.2
Hemolytic jaundice:		4	15	15	3.0
Totals		175		500	

*From the Thorndike Memorial Laboratory and the Second and Fourth Medical Services (Harvard) Boston City Hospital, and the Department of Medicine, Harvard University.

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‡Jaundice due to injury to liver cells.

due to cirrhosis. The patients evidently enter the hospital when there is an attack of acute hepatic necrosis or decompensation. The percentage is greater in this hospital group than in the cases encountered in private practice.

In Table 1 are also listed 175 proved cases that came to operation or autopsy.

In Table 2 are given the proved errors in these 175 cases. They are classified in groups, with the correct diagnoses in one column and the erroneous diagnoses in the next column.

The proved errors in the 175 cases that came to operation or autopsy totaled 14, or 8 per cent. Needless to say, in many cases of jaundice that were easiest to diagnose the patients did not die and were not operated on. These included patients with acute toxic and infectious hepatitis

TABLE 2. *Erroneous Diagnoses in 175 Cases with Operation or Autopsy.*

TYPE OF DISEASE	CASE NO.	ERRONEOUS DIAGNOSIS	CORRECT DIAGNOSIS
Complete obstruction	1	Cancer of common duct	Gallstones
Partial obstruction	2	Chronic genito-urinary infection	Cholangitis, abscess of liver
	3	Cirrhosis	Cancer of duodenum
	4	Cirrhosis	Primary cancer of hepatic ducts
	5	Cholangitis	Primary cancer of common duct
Hepatocellular jaundice:			
Acute hepatitis	6	Obstruction	Subacute yellow atrophy
Cirrhosis	7	Portal cirrhosis	Pigment cirrhosis
	8	Portal cirrhosis	Pigment cirrhosis
	9	Biliary cirrhosis	Portal cirrhosis, cholecystitis
Tumor of liver	10	Cirrhosis	Secondary cancer of liver (breast)
	11	Cirrhosis	Secondary cancer of liver (pancreas)
	12	Cholangitis	Secondary cancer of liver (esophagus)
	13	Possible cardiac cirrhosis; infarcts	Secondary cancer of liver (stomach)
Hemolytic jaundice	14	Hepatorenal syndrome	Arteriosclerotic heart; infarcts of lungs and spleen; passive congestion.

and hemolytic jaundice and many with chronic cirrhoses who had been under observation at the hospital for a long time, so that the actual percentage of erroneous diagnosis in the whole group was probably somewhat less than that given above.

KIND OF ERRORS

The known errors were in the chronic cases, with a single exception, a case of subacute yellow atrophy (Case 6).

Complete Obstruction

One case was diagnosed as cancer when it was absent, on the basis of complete obstruction of the biliary passages. A man of fifty-two (Case 1) with a history of increasing painless jaundice for two months and a final icteric index of 100, gray stools and entire absence of urobilinogen in the urine on daily tests over a period of ten days showed at operation gall-bladder disease, with the hepatic and common ducts solidly plugged with puttylike material and gravel, causing complete obstruction.

Partial Obstruction

A man of seventy-seven (Case 2) with a known chronic genitourinary infection, pyuria, pyelitis and prostatic abscess also had empyema of the gall bladder, cholangitis and multiple liver abscesses, with slight obstruction of the biliary passages. The jaundice was slight and lasted only two days. The genitourinary infection masked the biliary-tract infection, which was not recognized.

A man of sixty (Case 3) of alcoholic habits had continuous deep, painless jaundice for six weeks, a large firm liver, a high urobilinogen falling to normal, stools yellowish to gray and possible slight ascites. Barium x-ray films were normal. It was difficult to decide between terminal chronic hepatitis with loss of function and partial external obstruction. A diagnosis of portal cirrhosis was made. The autopsy showed a primary cancer of the duodenum that gradually involved the ampulla and pancreas and that was missed by the roentgen ray, with a few metastases in the liver. The partial obstruction that was present when the diagnosis of cirrhosis was made became complete in the last two weeks of life, with clay-colored stools and absence of urobilinogen in the urine.

A fifty-one-year-old man (Case 4), moderately alcoholic, had dull pain in the region of the right scapula, deep jaundice for one week, slight hematemesis and a little irregular fever. The liver was slightly enlarged. There was a question of a palpable spleen and some ascites. The stools were light brown, the urobilinogen in the urine was increased (positive on four occasions in dilutions of 1:32, 1:16, 1:64 and 1:4 respectively), and roentgen-ray examination of the stomach and bowel was normal. The patient continued to be deeply jaundiced for two months and died in coma. A diagnosis of portal cirrhosis was made, with latent carcinoma causing partial obstruction as the second choice. Autopsy showed primary carcinoma, partially blocking both hepatic ducts, with metastases in the liver, lungs and adrenal glands.

A woman of seventy-six (Case 5) with an unusual small, soft adenocarcinomatous polyp in the common duct had epigastric pain, chills and irregular fever, moderately deep jaundice, some increase in the size of the liver, bile pigment in the

stool and increased urobilinogen in the urine, and was considered to have partial obstruction of the common duct due to stone, with infection of the bile passages and liver. At autopsy, in addition to the polyp in the common duct, there was extensive cholangitis with multiple abscesses of the liver.

Hepatocellular Jaundice

Acute hepatitis. A sixty-year-old man (Case 6) had two weeks of painless, steadily increasing deep jaundice (icteric index 100 to 200), complete absence of urobilinogen in the urine for ten days and normal galactose-tolerance tests. The diagnosis wavered between subacute hepatitis and obstruction of the common duct, and the patient was finally operated on. A longer period of observation and tests might have avoided this mistake. At autopsy, a healing acute yellow atrophy was found.

Cirrhosis. Two cases of pigment cirrhosis (Cases 7 and 8) were called portal. Neither patient had external pigmentation or glycosuria, and both were hard drinkers. One case of portal cirrhosis (Case 9) with accompanying cholecystitis was diagnosed as biliary cirrhosis.

Tumors of liver. Cancer was overlooked in 4 cases. Two of these patients had secondary cancer of the liver from a tiny primary focus, which caused no symptoms whatever and was discovered only at autopsy. One patient (Case 10) had a nodule in the breast the size of a small pea, and the other (Case 12) had a tiny nodule in the esophagus.

One patient (Case 11) had a latent cancer of the body of the pancreas not involving the common duct, with massive secondary cancer of the entire liver.

In 1 patient with chronic decompensated valvular heart disease (Case 13), the roentgen-ray examination of the stomach was unsatisfactory on account of weakness and vomiting. A cancer was suspected but not proved. Actually a medium-sized prepyloric cancer was present, with massive involvement of the liver.

Hemolytic Jaundice. In a case of acquired hemolytic jaundice the diagnosis failed. A man of forty-one (Case 14) with chronic arteriosclerotic heart disease developed deep jaundice after ten days in the hospital (icteric index 40 to 100). He had multiple venous thromboses from venipuncture for the use of Mercupurin, signs of multiple infarcts in the lungs, moderate uremia (anuric for one day, with the nonprotein nitrogen 70, 82, 50, 60 and 30 mg. per 100 cc. in five successive samples of blood), some bile in the urine and evidence of liver damage (the urobilinogen in the urine rising and remaining positive in a dilution of 1:128). The liver was 2 to 3 cm. below the costal margin.

The vague diagnosis of hepatorenal syndrome was made on the basis of combined hepatic and renal damage. The autopsy showed, in addition to the above, infarcts in the spleen, a pathologic gall bladder containing two stones, with the large patent bile ducts, and passive congestion of the liver and kidneys. This confusing picture of multiple disease was dominated by hemolytic jaundice from the multiple infarcts in the lungs and spleen, to which insufficient attention was paid.

Discussion

Errors of Diagnosis

Of 29 proved cases of complete obstruction, 28 (97 per cent) were due to cancer, and of 61 proved cases of partial obstruction of the common or hepatic ducts, 56 (92 per cent) were due to benign conditions. The 5 cases of cancers with partial obstruction of the external biliary passages comprised the following: 1 case (Case 3) of cancer of the duodenum with extension to the pancreas in which partial obstruction became complete in the last two weeks of life, 3 cases of almost complete obstruction — namely, 2 cases of cancer of the head of the pancreas correctly diagnosed and 1 (Case 4) of cancer of the hepatic ducts — and 1 unusual case (Case 5) of a soft pedunculated adenocarcinoma of the common duct 1 to 2 cm. in diameter.

The presence of complete obstruction with continuous absence of bile from the feces and of urobilinogen from the urine has strongly favored the diagnosis of cancer involving the common duct (in the head of the pancreas, the ampulla of Vater or the common duct) or both hepatic ducts. When a cancer obstructs the common duct and has caused well-marked jaundice, it usually does not take long to produce complete obstruction, judged by the continued absence of urobilinogen from the urine with the Wallace and Diamond[3] test or a very low figure (0 to 0.3 mg. daily) with the Watson[4] test.

One case (Case 1) of complete obstruction of the common duct was diagnosed as a cancer when it was stone. This mistake was not important except for the prognosis, since, in either event, surgery was required.

There was a great difference in the importance of the errors in the various groups. The error was most serious in Case 6, in which a patient with acute hepatitis was operated on for obstructive jaundice and died of bronchopneumonia, and was found to have a healing subacute yellow atrophy. This case was encountered six years ago; this mistake has not been repeated, and we have had several opportunities to restrain sur-

geons from exploring other patients at an early stage of the disease.

The determination of the cause of the jaundice in the first day or two of the disease is not essential since these are not emergency cases. In acute deep jaundice a short period of study is especially needed to avoid operating early with a diagnosis of complete or partial obstruction without adequate knowledge of the liver function or the surgical risk and course of the jaundice and without making the best diagnosis possible. A good rule in acute deep jaundice with brown stools is to avoid surgical treatment. The disease is obviously not due to external obstruction, but chiefly or entirely to damage of the liver cells (acute hepatitis, cirrhosis with acute necrosis and so forth). The risk of operating for severe or acute diffuse hepatitis at the height of the jaundice is extremely great. This is seen when the mortality of ordinary gall-bladder operations, from 2 to 5 per cent, is compared with that of about 35 per cent in operations on cases of cirrhosis and with one of nearly 100 per cent in operations on cases of acute yellow atrophy or severe acute hepatitis. In acute jaundice it was often a serious question how long to wait to watch the course of the disease. In acute cases without obvious infection and pain (acute hepatitis, necrosis in cirrhosis, obstruction by stone or hemolysis), the danger lies entirely on the side of early operation in cases with a wrong diagnosis. In chronic cases there is no reason to hurry a difficult diagnosis. Most patients with obstruction due to stone preserve good liver function for a long time, and other cases are either unsuitable (cirrhosis) or unsatisfactory (cancer) for surgery.

Too many diagnoses of cirrhosis were made when latent cancer was present, chiefly because the patient was a steady drinker and had a deficient diet and enlarged liver. The large majority of steady drinkers (over 90 per cent) never develop cirrhosis. Various cases of cancers were called cirrhosis, but no case of cirrhosis was called cancer. The best differentiation is achieved through the history and physical examination, but ascites may occur in both diseases and a palpable spleen may be absent in both.* Liver-function tests usually show some damage in both. This is more marked in well-developed diffuse cirrhosis than when nodules of cancer are scattered through a normal liver, on account of good compensation of the latter.

It is easy to confuse portal cirrhosis with the toxic cirrhosis that follows an attack of subacute yellow atrophy of the liver (Mallory[5]) when the acute attacks of the latter are not striking or occurred so long ago that they have been forgotten. Erroneous diagnosis of cirrhosis, such as calling pigment cases portal, is of minor importance, since the treatment is similar for both — namely, medical.

There was 1 proved case of primary cancer of the liver (hepatoma) in the 41 cases of cirrhosis that came to autopsy. This is rarely discovered clinically, but is chiefly diagnosed pathologically.

Over half the proved errors — namely, 8 out of 14 — were associated with cancer. One case (Case 1) was diagnosed as cancer because of complete biliary obstruction; cancer, however, was absent.

Cancer was overlooked in 7 cases. Of these, 4 (Cases 3, 4, 10 and 11) were called cirrhosis, 2 (Cases 5 and 12) were called infections of the liver (cholangitis with multiple small abscesses), and 1 (Case 13) was diagnosed as chronic passive congestion of the liver with possible infarcts in a patient with decompensated rheumatic mitral and aortic disease of long standing. These 7 cancers were difficult to find clinically. In 1 case primary cancer of the duodenum (Case 3) was missed by the roentgen ray. Cancer was primary in the bile passages in 2 cases, in the common duct in 1 (Case 5) and in the hepatic duct in 1 (Case 4). In 4 cases it was secondary — arising in 2 from tiny foci in the breast (Case 10) and esophagus (Case 12), in 1 (Case 11) from a latent cancer of the body of the pancreas and in 1 (Case 13) from a cancer of the stomach in a patient too weak for examination. These 7 cases of latent cancer within the liver or bile passages were extremely serious, with no opportunity for palliative surgical treatment, which in some cases was useless and in others was impossible because of the poor condition of the patient. Fever and leukocytosis in late cancer may simulate cholangitis and liver abscess. Probably an error in diagnosis can be avoided by a more frequent consideration of the possibility of cancer.

Multiple lesions were sometimes confusing. The symptoms of one lesion overshadowed those of another, as in Case 2, in which an obvious genitourinary infection covered the signs of a latent but extensive infection of the biliary tract. In Case 13, a patient with a chronic valvular heart disease showed well-marked symptoms, whereas the cancer of the stomach and liver were only vaguely suspected. In Case 9, the cholecystitis was easily diagnosed but the portal cirrhosis was latent.

Ease of Diagnosis

There was a great difference in the ease of diagnosis of the different diseases. The easiest

*The methods of diagnosis will be discussed in a later paper.

to diagnose was toxic hepatitis in which there was a history of exposure to arsenic, cinchophen, chloroform, carbon tetrachloride, gold thiosulfate or some other drug and in which no mistakes in diagnosis were made. Patients with toxic cases may have multiple diseases such as syphilis and arsphenamine hepatitis, with alcoholic cirrhosis or cancer.

The disease next easiest to diagnose was complete obstruction, which was apparent on the basis of absence of bile in the bowel, determined not only by the color of the stools but better still by the complete absence of urobilinogen from the urine on repeated tests. All but 1 of these cases were cancerous.

Hemolytic jaundice had so many distinctive features that with careful study the diagnosis was usually easy. In chronic familial cases, the history, lack of pain, anemia, low-grade icterus, splenomegaly, small spherocytes, increased fragility of the red cells, presence of reticulocytes, lack of bile in the urine (usually), an excess of bile pigment in the feces and an indirect van den Bergh's reaction in the blood are distinctive. The presence of bile in the urine does not rule out hemolytic jaundice, since in some cases there is accompanying liver damage, apparently due to anoxemia (anemia, heart disease, pneumonia and so forth).

The sudden appearance of jaundice in patients with chronic myocardial insufficiency should make one suspect pulmonary infarct as a cause of the jaundice, even without local signs (Keefer and Resnik[9]).

The diagnosis of gall-bladder disease is relatively easy with modern methods, — the history and physical examination combined with Graham tests, biliary drainage and so forth, — as was also the diagnosis of acute pancreatitis with the additional help of early tests of the urinary diastase. Some patients were too sick for thorough examination, and this proved to be a source of error, as in Case 13.

Diagnosis of cancer of the liver was easy following previous operation for cancer of the stomach, bowel, prostate, pancreas and so forth or by biopsy of a lymph node, but the most difficult cases for diagnosis were those of small or latent cancer of the liver and common or hepatic ducts, which were not always distinguished from cirrhosis and cholangitis.

There are several small groups of cases in which no error in diagnosis was made that is worth mentioning.

Only 8 cases were classified as simple fatty liver; in 1 of these an alcoholic patient developed pneumonia and died. The autopsy showed a large, soft, fatty liver without cirrhosis. In the other proved cases the fatty livers were complicated by cirrhosis. Unproved cases with two or more of several clinical signs — a much enlarged liver, jaundice, ascites, an enlarged spleen, varices, a low serum albumin, low prothrombin, edema, hemorrhages and poor liver function — were classified as fatty portal cirrhosis.

There were only 4 cases of acute pancreatitis with jaundice, all correctly diagnosed and all associated with gallstones. The diagnosis was relatively easy with the combination of jaundice, severe epigastric pain, vomiting, leukocytosis and, especially, marked increase of urinary diastase (in dilutions of 1:300, 1:1600, 1:2200 and 1:7500, respectively). No diagnosis of chronic pancreatitis was made, and no case was discovered at operation or autopsy.

Syphilis of the liver was proved in only 1 case (0.6 per cent) in the group of 175 jaundiced patients who came to operation or autopsy, and was not diagnosed again in the total series of 500 cases. A man of seventy had been explored thirty-five years previously at another hospital for an abdominal tumor, which proved to be a gumma of the liver with adhesions to the stomach. Treatment was inadequate. When he entered this hospital because of dull pain in the right upper quadrant of the abdomen, the jaundice was slight (icteric index 13), the liver was large, firm, irregular and tender, a blood Hinton reaction was negative, there was no ascites, and liver-function tests were almost normal. Peritoneoscopy was unsatisfactory because of omental adhesions to the liver. The reported incidence of syphilis of the liver has gradually lessened in recent years, probably as a result of earlier and better treatment.

Weil's disease (spirochetosis icterohemorrhagica) was not diagnosed or found post mortem in this series. It is evidently rare in this region, but the apparent rarity may be due in part to the fact that the clinical picture and laboratory methods are not well known. If earnestly looked for by means of proper bacteriologic procedures in cases of acute infection or catarrhal jaundice, cases will occasionally be recognized.*

Summary and Conclusions

The proved errors in diagnosis in 175 cases of jaundice that came to operation or autopsy was 14 (8 per cent).

The known errors, with one exception, were in the chronic group, and over half the errors were associated with the diagnosis of cancer, almost always in overlooking small or latent tumors.

*Three cases were found on other medical services at the Boston City Hospital in the last five years

It is evident that latent cancer should be considered much oftener in doubtful chronic cases. There was a tendency to make too many diagnoses of portal cirrhosis in alcoholic patients with an enlarged liver. Various cancers were called cirrhosis, but no case of cirrhosis was called cancer.

Complete obstruction of the external bile ducts was due to cancer in 96 per cent of the proved cases, and partial obstruction was benign in 91 per cent.

The essential need is to separate medical from surgical cases of jaundice. This is far more important than is the diagnosis of the specific disease of the liver; for example, it is far more important to differentiate hepatitis, the treatment of which is essentially medical, and complete obstruction, in which it is essentially surgical, than to decide just which kind of cirrhosis or complete obstruction is present.

Cases of jaundice are rarely emergencies, and it is best not to hurry the diagnosis in most acute or chronic cases, especially in the absence of serious infection (cholangitis, abscess of the liver, empyema of the gall bladder, perforation or peritonitis), and not to trust to early impressions, which are often reversed by the course of the illness and the laboratory tests. It is especially necessary not to make the early diagnosis of acute deep jaundice a basis for early surgery, which in this series had a high mortality in the wrongly diagnosed cases. A period of study, with the giving of plenty of glucose and water, protein and vitamins, is essential in order to watch the course of the disease and to see which element predominates—damage to the liver cells, external obstruction or hemolysis.

If unexplained jaundice appears in chronic heart disease, pulmonary infarct or hemolytic jaundice should be considered.

The ease of diagnosis of jaundice was approximately in the following order. The diseases easiest to diagnose were toxic and infectious hepatitis, complete external obstruction and hemolytic jaundice. Those moderately difficult to diagnose were fatty liver, acute pancreatitis, gall-bladder disease with partial external obstruction and cirrhosis. The most difficult to diagnose were multiple lesions, cases in which the patients were extremely sick and had incomplete examination and tumors of the liver and bile passages.

The differentiation of hepatocellular and obstructive jaundice and of stone from cancer in the common duct has become easier in the last ten to twenty years, but the difficulty of discovering various latent cancers causing jaundice remains.

Syphilis of the liver is less common than in the past, there having been only 1 proved case. No cases of Weil's disease or chronic pancreatitis were diagnosed or found.

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MEDICAL PROGRESS

INDUSTRIAL HYGIENE

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FOR the first time in the history of the United States, its manpower has been found to have quantitative limits. Since this commodity cannot be rapidly expanded, human resources must be husbanded; and since industrial hygiene is concerned with the preservation and improvement of the health of the worker, it has assumed a greater importance than heretofore. Conspicuous advances have been made not only in the prevention of specific occupational hazards, but also in the development of the public-health viewpoint in industry with the worker as the chief recipient of its benefits.

The application of newer knowledge in industrial hygiene has been constantly expanded under the stimulus of federal funds, which have since 1936 been aiding state industrial-hygiene activities. At the present time, there are approximately forty-seven units in thirty-eight states with about three hundred active workers.[1] Co-operative arrangements between these state units and other agencies responsible for worker health have been effective in spreading the recent gains in industrial hygiene.

SPECIFIC OCCUPATIONAL HAZARDS

The war has introduced a host of new chemicals of relatively unknown toxicity, besides accelerating the use of the numerous substances about whose toxicity much is known. Modern industry rests on a chemical base, and its constant development continuously creates new problems in industrial hygiene. Some of these are of temporary nature, but many will continue into the postwar world.

The Pneumoconioses

The pneumoconioses are still a fruitful source of medical investigation, since many points about them are still to be defined. The roentgenologic picture has been thoroughly reviewed by Pendergrass,[2] who has admirably summed up the difficulties and variations in the x-ray interpretation of occupational disease of the thorax. It has been customary to think that the only disabling pneumoconioses are those due to silica and asbestos. Recent investigations, however, create the belief that the list will have to be expanded to include such silicates as talc and mica, and the literature abounds in cases of pneumoconioses from various minerals and earths.[3, 4]

Porro et al.[5] presented 15 cases of talc pneumoconiosis, including 5 autopsies, and in 13 of these the disability was directly attributable to the pneumoconiosis. Talc dust varies greatly mineralogically, and the highest incidence occurs in those workers exposed to talc with a high percentage of tremolite.[6] Mica, another silicate, has given rise to an incidence of lung fibrosis of 11.4 per cent in miners of this mineral.[3]

Certain dusts such as coal and aluminum have not only been called harmless but are stated to have an antidotal effect. More recent investigations, however, indicate that these substances are not entirely harmless and may in fact cause some degree of pulmonary fibrosis. Anthracosilicosis is rather frequent, as recent surveys have proved.[7, 8] The dangers to the lung from aluminum have been discussed in the German literature. It is stated that aluminum dust must be included in the list of pneumoconiosis-producing substances, although it remains to be proved whether it produces specific lesions.[9, 10] On the other hand, Crombie and Blaisdell[11] report encouraging results from the symptomatic treatment of silicosis with aluminum dust and believe that it is an effective preventive. Silica is soluble to about 200 parts per million, and a small amount of metallic aluminum is stated to reduce this solubility to about 6 parts per million.

The study of the pathology of silicosis has continued. It has always been defined as a local disease of the lungs and thoracic lymph nodes. Recently a case came to autopsy that also showed systemic dissemination of silicotic nodules in the liver and spleen.[12]

Engineering methods of dust control have progressed to the stage that, in most industries, no worker need be exposed to a hazardous concentration of any pneumoconiosis-producing dust.

A number of new pulmonary syndromes have

The articles in the medical-progress series of 1941 have been published in book form (*Medical Progress Annual*. Volume III. 678 pp. Springfield, Illinois: Charles C Thomas, 1942. $5.00).

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recently been described, and a fairly definite one, called "bagassosis," has been reported from the English literature. This lung disease is due to dust created by the crushing of broken sugar cane after the sugar has been extracted. Many exposed to this fine dust become sensitized and after several months develop dyspnea, cough, weakness and anorexia. The illness is severe and prolonged, but recovery ultimately takes place. The x-ray picture is similar to that of an inflammatory condition. Cases have recently been reported as having occurred in Louisiana, where a similar process is in operation.[13, 14]

Another interesting lung disease has recently been reported in persons working in beryllium-recovery plants.[15, 16] This pulmonary condition is characterized by dyspnea, cough and low-grade fever. The illness usually lasts about three months, and the x-ray picture suggests a diffuse inflammatory inhalation reaction. Practically all the affected workers recovered, but there have been a few fatalities. A group of cases similar to these have occurred recently among workers engaged in making electrical equipment and lamps.[17] This condition is characterized by dyspnea and cough, weakness and loss of weight. The illness runs a more chronic course. One autopsy demonstrated the pathological findings of sarcoidosis. The x-ray picture is consistent with this diagnosis.

Lead

Lead, historically the most ubiquitous hazard to industrial health, is today being met with ever more frequently, and often in quite new roles. Although the usual industrial uses, as in foundries, paint making and storage-battery manufacture, continue to contribute their quotas of lead poisoning, many salvage operations coming to the fore, such as the oxyacetylene cutting of steel, which has been previously covered with lead paint, are proving highly dangerous.[18] Fatal cases of encephalopathy occurring from inhaling fumes from storage-battery boxes burned as fuel have been reported.[19] Such engineering aids as ventilation and wet mining methods have, however, helped to cut down the high incidence of lead poisoning in a number of industries.[20] The factors involved in the industrial exposure have received further attention, and the standard of 1.5 mg. per 10 cu. m. of air has been well substantiated as the upper limit of tolerance.

Experimentally, investigation has been going on regarding the behavior of lead in body tissues. The behavior of lead in the organism as a whole is dependent on the mechanism of its storage in the body, and means of identification in body tissues have been perfected by Fairhall and others. The dropping mercury electrode and the development of radioactive lead as an indicator give promise of greater advances to come.[21–25]

The therapy of lead poisoning is still not entirely clarified. In the past, ascorbic acid was suggested as a means of increasing the lead excretion,[26] but clinical observation has not proved that this vitamin has any effect on increasing the excretion of lead from the body.[27] The value of milk is somewhat controversial, but there is growing evidence that a person with a positive calcium balance retains less lead. Although milk cannot be considered the keystone of any preventive or therapeutic regime, it is of value in workers exposed to this hazard.

The physical signs and symptoms of lead poisoning have been thoroughly reviewed in articles by Kehoe[28] and Ashe.[29] Lead poisoning is primarily a clinical syndrome. Diagnosis is helped by study of the excretion, but the final diagnosis depends on an interpretation of clinical symptomatology, which affects chiefly the gastrointestinal and neuromuscular systems. Elimination of ingested lead is accomplished spontaneously, even without "de-leading." Gross changes in the acid-base balance or calcium-phosphorus metabolism of the body are not affected if the lead exposures are kept within tolerance limits.[30]

Control of the lead hazard has been aided in several states by the development of a health-department laboratory service similar to the Wassermann service offered by many states. Lead-free kits are distributed to physicians for the transmission of samples through the mails. This technic has not been adopted universally as yet, but has promise of further development as the medical profession becomes aware of the increasing incidence of lead poisoning.[31, 32]

Miscellaneous Chemicals

An ever greater variety of miscellaneous toxic chemicals are finding use in industry. The two groups that have been especially studied because of their widespread application and particular necessity in wartime are those compounds that are used as solvents and those used in the making of munitions. The general use of benzol as a solvent has decreased somewhat as manufacturers have become increasingly aware of its toxic qualities. Some of its industrial uses are, however, still widespread; but fortunately many of these processes are carried out in closed systems, and hence no fumes are liberated under usual operating conditions.

The group of compounds known as chlorinated hydrocarbons are extensively used as degreasers

and as solvents. Carbon tetrachloride, although still widely used, has yielded in many instances to trichlorethylene. This latter substance, while less toxic, can cause serious effects and there is an unjustified complacency about its use.[33] The maximum allowable limit in workroom air is 200 parts per million, twice the figure hitherto accepted for carbon tetrachloride, since it is excreted fairly rapidly as trichloracetic acid after detoxification in the body.[34] The symptoms of an excess inhalation of this substance are dullness, nausea, vomiting and coma. Reports in the literature still demonstrate the menace of carbon tetrachloride, which in acute poisoning gives rise to liver and kidney damage, coma and death; it is urged that the maximum allowable limit of this compound be revised drastically downward, since numerous cases of nausea and headache have occurred among workers exposed to less than 100 parts per million, the figure until recently thought to be safe.[35-37]

Ethylene dichloride, also a chlorinated hydrocarbon, is now used as a rubber solvent. Its toxicity is not completely defined, but apparently it too can cause nausea, vomiting and liver damage. Experimentally, it produces an irritation of the eyes in low concentrations. The present maximum figure of 200 parts per million may have to be revised downward.

Toluene has in many instances replaced benzol as a solvent. Although less toxic, it nevertheless can produce hepatomegaly, macrocytosis, a moderate secondary anemia and an absolute lymphocytosis. These changes may occur without any symptomatology. Hence, power ventilation is often necessary where toluene is used.[38]

Munitions making is still quite hazardous to health, but ventilation procedures have greatly reduced these dangers. No special advance has been made in the medical knowledge of poisoning by trinitrotoluol (TNT), the maximum allowable limit for which has been set at 1.5 mg. per 10 cu. m. of air. Tetryl, a common explosive, is a potent source of dermatitis, and there is some evidence that it may be a systemic toxin. The dermatitis is characteristic, as is the yellow staining of hair and skin.[39] Detonators and "boosters" in munitions making, such as lead azide and mercury fulminate, are toxic when inhaled or absorbed. Fortunately, exposures to both these substances are well controlled, since they are most dangerous from the explosive standpoint.

The hazards associated with welding have been more clearly defined. Metal-fume fever, which occurs when zinc and other metallic oxides are inhaled in sufficient quantities, has been shown to be a well-defined syndrome.[40] It is characterized by chills, fever and leukocytosis several hours after the exposure, clearing up without sequelae within a day or so. This exposure, as well as those to carbon monoxide, nitric oxide fumes, fluorides and other materials used in the welding fluxes, may usually be controlled by adequate power ventilation.[41]

Mercury and Radium

Since December, 1941, no mercury-carroted fur has been used in the making of felt hats. This has resulted in a decrease in the incidence of chronic mercurialism. Occasional cases are still reported from other industries, and mild cases have been known to occur among physicians and chemists exposed to mercury during laboratory procedures. This hazard is not generally recognized, but since mercurialism may result either from ingestion, inhalation of vapor or absorption through the skin, it is not uncommon where mercury is carelessly handled.

The best guide in chronic industrial poisoning is determination of the urinary excretion, since little or no mercury is normally found in the urine except in persons with a recent amalgam filling or in cases where a mercurial antiseptic has been used.[42] Standards for atmospheric contamination have been evolved, and the American Standards Association has accepted 1 mg. per 10 cu. m. of air as the maximum allowable limit.[43] The mining of mercury is still hazardous, but the incidence of mercurialism has been kept down by the use of a new chemical spray in the mines. This consists of a lime-sulfur mixture with a suitable wetting agent. When sprayed on the working surfaces of the mine, it reduces the volatilization and has proved effective in conjunction with good housekeeping.[44]

The necessity for employing self-luminous compounds on the dials of instruments used in combat vehicles has intensified the industrial use of radioactive substances. The expansion in terms of number of workers has increased over fifty-fold, but the hazard of radium poisoning has fortunately this time been recognized and extensive measures have been taken to prevent it. A number of states have promulgated codes designed to prevent the ingestion or inhalation of abnormal amounts of radium. The development of extremely sensitive physical methods of determining the amount of radium stored in the body has helped greatly as a guide to prevention. One tenth of a microgram of radium has been established as the maximum permissible storage limit. So far, no cases of radium poisoning have been reported, and it is hoped that the preventive measures now instituted will obviate the occurrence of cases similar to those that followed the last war.[45-49]

Dermatoses

Dermatitis continues to be one of the major problems confronting the industrial physician and, in terms of morbidity, is the greatest single factor contributing to absenteeism from illness. Dermatitis as a result of contact with the cutting oils used in machining operations is still the most frequent type. No one method of control is adequate, but effective preventive measures center in personal protective devices and proper methods of cleansing the skin. Protective clothing and protective creams are helpful in minimizing contact, and these, together with hot water, a good soap and frequent bathing, greatly reduce the hazard. Harsh abrasive mixtures and strong solvents must be avoided. The use of clean oil helps to keep down the incidence of oil pimples, but sterilization of reused oil, either by chemicals or heat, is not indicated, since infection is produced by organisms normally present on the skin.[50]

Dermatoses due to a host of sensitizing and allergic agents are of common occurrence, and almost any substance used in industry may cause a rash. Such conditions cannot be adequately prevented by pre-employment patch testing; measures of control must rather be in the nature of job transfer, cleanliness and skin-protective devices. Burns produced by the action of strong acids and alkalies can usually be prevented by proper work methods and protective clothing. Prevention of the defatting effects of strong solvents, with drying, fissuring and dermatitis, lies mainly in the use of mechanical aids in manufacturing, in protective clothing and in the restoration of the fat content of the skin.

Dermatitis due to chlorinated naphthalenes and diphenyls, waxes used in the insulation of electrical cables, is most troublesome in the installation of these cables in fighting ships. Control is effective only through proper hygienic methods. A cleansing mixture of butyl stearate and sulfonated castor oil, which removes the wax from the skin, has been suggested and seems effective.[51]

Anthrax, an infection entering usually through the skin, is still of frequent occurrence, cases continuing to be noted among wool sorters, tannery workers and others engaged in the transport of these materials. Control lies in prompt attention to minute abrasions in workers potentially exposed to this hazard, of which it is essential that they be made aware. Methods of treatment, including serum and sulfonamides, are effective if promptly applied. Penicillin has been reported to be effective in 1 case.[52]

Public-Health Aspects

Industrial hygiene includes in its scope numerous activities related to the general health of the worker. These have quite rightly come to the fore in the wartime program, since it is recognized that specific occupational disease accounts for no more than 5 per cent of the workers' disability from illness and that the general sicknesses to which mankind is heir account for the rest. Hence, in keeping the worker on the job, it is most important to attack directly all problems that affect morbidity and mortality, including those due to a hazardous working environment.

In many states a program of tuberculosis case finding in industry has been undertaken by means of a mass survey. This has been aided by the development of a photofluorographic unit, a number of which have been placed at the disposal of state industrial-hygiene divisions by the United States Public Health Service.[53] A venereal-disease program has been outlined and is gradually making progress, although it is less readily accepted by industry than are some other public-health measures.[54, 55] Problems of sanitation and community health that affect the industrial environment have also received attention.

Probably the most significant advances have been those in the field of nutrition, and numerous developments have brought attention to this phase of public health so important to the worker. The special problems of in-plant feeding, outfeeding, nutritional requirements, food costs, vitamin supplements and so forth have been integrated into programs that are finding widespread acceptance in industry.[56-58]

Although hampered by the paucity of physicians, nurses and equipment available, many industries have adopted pre-employment and periodic examinations and have established medical departments with adequate equipment and staff. Developments are under way in the provision of medical and nursing care to small industries through visiting nurses' associations and other agencies.

The great influx of women into the nation's factories has caused their place in industry to be carefully studied by the United States Department of Labor, the United States Public Health Service and the state industrial-hygiene units. Standards have been promulgated for the effective employment of women, taking into account their physical characteristics.[59]

Education in industrial health has by no means been neglected, and an active program is being formulated by the United States Public Health Service. The problem of absenteeism and its causes has received careful analysis, and progress has been made toward reducing this defect in the all-out war effort.

23 Joy Street

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CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

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CASE 29521

PRESENTATION OF CASE

A sixty-nine-year-old retired schoolteacher was admitted to the hospital because of pain in the epigastrium and left shoulder of three hours' duration.

The patient was in excellent health until ten or twelve years before admission, at which time she began to have epigastric distress without any real pain. The distress was described as "acidity." She had occasional gaseous eructations but no vomiting. She was given a Sippy powder after each meal, which relieved the burning. She had continued to take the powder.

Ten years before entry she had a "typical story of coronary thrombosis for which she was given bed rest and morphine." Eight years prior to admission she became a vegetarian. There was a 20 or 30 pound loss in weight following this. The epigastric distress continued and was relieved by the Sippy powder.

Two or three weeks before entry, there was increase in the severity of the symptoms and for the first time she developed epigastric pain, which increased on the day of admission. After taking the Sippy powder, she suddenly became extremely sick and vomited "brownish, bloody material." The pain disappeared but she remained weak. She had noodles for supper, following which she became nauseated, went to the bathroom and fell down unconscious, striking her forehead. There was no vomiting or bowel movement at that time. It was not known how long she remained unconscious. On becoming conscious she vomited brownish material followed by bright-red blood. "Later" she had a black tarry bowel movement. Either before the vomiting or after it, she complained of burning epigastric pain, which radiated to the back and to the left shoulder and was accompanied by marked dyspnea. Morphine, administered by her physician, relieved the pain.

Physical examination on admission showed a thin, acutely ill woman sitting up in bed. She was cyanotic and breathed in a rapid, shallow manner. She had periods of drowsiness, but between these she was fairly alert. There was slight dullness over the right base; the breath sounds were normal, and there were no rales. The heart was enlarged to the left. The sounds were of fair quality, and a soft apical systolic murmur was heard. The abdomen was distended, tympanitic and "firm," but there was no spasm, tenderness or masses. Peristalsis was normal. Pelvic and rectal examinations were negative.

The blood pressure was 154 systolic, 80 diastolic, on the right, and 130 systolic, 70 diastolic, on the left. The temperature was 99°F., the pulse 90, and the respirations 38.

Examination of the blood showed a red-cell count of 4,000,000, with 13.7 gm. of hemoglobin. The white-cell count was 16,000, with 97 per cent neutrophils. The urine was normal, with a specific gravity of 1.022. The stools were tarry, with a ++++ guaiac test.

X-ray examination showed no definite air below the diaphragm. There was a peculiar shadow behind the heart, which could represent air within the mediastinum or disease within the lung. A repeat x-ray examination on the following day showed areas of atelectasis at both bases and probably a moderate amount of fluid in the left pleural cavity. Films of the abdomen showed considerable gas and fecal material in the colon but no definite evidence of intestinal obstruction. During the course of examination she had an episode of "bradycardia with arrhythmia" associated with fainting. This lasted one or two minutes and did not recur. She continued to vomit dark-brown, guaiac-positive material for the next two days. The pain persisted and was worse with respiration. She was given intravenous fluids.

On the third hospital day the temperature rose to 104°F., and the pulse to 140, but the respirations remained around 40. Examination showed dullness over the left chest from the fifth interspace down posteriorly, with diminished breath sounds, tactile fremitus and vocal fremitus. Grocco's triangle was present, as was an area of bronchial breathing at the right base near the spine. There was a questionable friction rub in the left axilla. X-ray examination of the chest revealed a considerable amount of fluid in the left pleural cavity. A swallow of barium showed a large diverticulum in the lower esophagus. No free air could be seen under the diaphragm. The stomach contained a considerable amount of fluid, and the single swallow of barium dropped through the retained fluid and food. Examination was discontinued. A chest tap yielded 200 cc. of blood-

*On leave of absence.

tinged, nonodorous fluid, which showed 1500 red cells and 5000 white cells per cubic millimeter, with 90 per cent polymorphonuclears and 10 per cent lymphocytes. A culture of the fluid showed many colonies of nonhemolytic streptococci and few of colon bacilli. The patient was given 5 gm. of sodium sulfadiazine. The following day she was distended and had some tenderness but no spasm. Another 350 cc. of fluid was withdrawn through a tap in the ninth interspace, without any improvement in the dyspnea. The fluid was brownish, cloudy and foul smelling.

The temperature slowly fell, but the pulse and respirations remained more or less stationary. The blood pressure was 140 systolic, 85 diastolic, in both arms. Despite oxygen therapy, the patient became steadily more cyanotic and died on the fifth hospital day.

Differential Diagnosis

Dr. William B. Breed: I do not believe that this woman had coronary occlusion at any time. I believe that she had some congenital defect in the diaphragm. She may have had an ulcer in or about a hiatus hernia. Certainly she had some gastritis in that area, which would explain a good deal of the story later on. I think that there was a rupture of some part of the gastrointestinal tract into the left pleural cavity. Just where it was—in the stomach or in the colon—I do not as yet know. Let us go through the data and see how firmly such a diagnosis stands.

The "acidity"—a symptom that might have responded well to Sippy powders—could perfectly well have been due to a small hiatus hernia or gastritis. Regarding the story of coronary thrombosis, let it be remembered that symptoms due to hiatus hernia are often confused with those of coronary heart disease; and we have no evidence, except the patient's own statement, that she ever had a coronary occlusion. The disease process that I have already mentioned could perfectly well have produced the symptoms described. We have no evidence at hand that she had a bad heart, and no electrocardiogram to indicate old scarring or recent coronary disease. The heart sounds were said to have been good, and the heart was said to have been enlarged to the left. Too much emphasis should not be placed on this clinical observation in the presence of disease in the left pleural cavity. Two or three weeks before she came in she certainly had gastrointestinal bleeding, which could have been caused by a hiatus or diaphragmatic hernia, or by an ulcer in that region. Ulcers occasionally do occur in the region of a hiatus hernia. We know that gastritis may be present about a diaphragmatic hernia, and that a patient may bleed from either of these conditions. I have never personally known or read of a case in which a hiatus hernia perforated into the pleural cavity. I am presupposing that she had a defect in the diaphragm. I do not know how much of the gastrointestinal tract might have herniated through from time to time. There may have been a perforation, let us say, of the colon. We know that the stomach does not contain colon bacilli. We know that there were a few colon bacilli found in the left pleural cavity along with nonhemolytic streptococci. She had no evidence of chronic anemia or of blood loss. She had some leukocytosis, which could be explained by an infectious process in the left pleural cavity. She had occult blood in the stool two or three days after the initial hemorrhage, which does not necessarily mean she was still bleeding.

I should like to ask a few questions about the x-ray examination. In two places it is stated that no definite air was seen below the diaphragm. I should like to have comment on that. I should also like to have explained the statement: "The stomach contained a considerable amount of fluid, and the single swallow of barium dropped through the retained fluid and food. Examination was discontinued."

Dr. Laurence L. Robbins: I do not know why it was discontinued unless the patient's condition was poor. Probably the reason why the statement about no free air beneath the diaphragm was made is that there was a question of perforated hollow viscus. I am not at all sure that the films were taken in the correct position to determine whether there was free air beneath the diaphragm. Assuming that they were, there is no visible free air. There is a process in the left lower lung field that apparently consists of fluid within the pleural cavity; this markedly increased in amount in twenty-four hours. There probably is consolidation in the left lower lobe. One shadow definitely bothers me, and that could be a hernia.

Dr. Breed: It could be part of the stomach?

Dr. Robbins: Yes; but I am not sure that it is. I do not know what the fluoroscopist thought. His examination was probably not sufficient to rule out a hernia. The diverticulum that was described is this dense shadow just below the bifurcation of the trachea, and again we have to take the fluoroscopist's word that it is a diverticulum, which is most likely. We have evidence of a large amount of fluid and other material in the stomach.

Dr. Breed: What about the swallow that dropped down through the fluid? Either it means something or it should not have been put in.

Dr. Robbins: It is merely an indication that there was foreign material in the stomach and

that the patient was not adequately prepared for a gastric examination.

DR. BREED: Certainly you see no barium above the diaphragm in either of these films.

DR. ROBBINS: No.

DR. BREED: You speak of a ruptured viscus. Are you thinking about stomach, esophagus or colon — the same things I have mentioned?

DR. ROBBINS: Yes.

DR. BREED: You would not like to add anything more?

DR. ROBBINS: No. I do not believe that the x-ray examination was complete.

DR. BREED: I take it that on the first examination the left chest was clear, since it is not mentioned in the record. Perhaps Dr. Beckman knows about this case. Do you?

DR. WILLIAM BECKMAN: Yes.

DR. BREED: Then there was quite a sudden change in the examination of the left chest?

DR. BECKMAN: Yes.

DR. BREED: That is very striking and certainly leads one to suspect that the foul-smelling fluid that was removed after twenty-four hours contained more colon bacilli than did the fluid obtained at the original tap. If so, then one would certainly look below the pylorus for the source of this fluid. As I have already mentioned, the normal stomach is peculiarly free from colon bacilli, nor does the duodenum contain many colon bacilli. If we could be assured that the foul-smelling odor of this fluid was due to the colon bacillus, we should have to assume that it was coming from the large or small intestine. Of course the patient may have had vascular disease, but I am inclined to doubt it. One must always consider such a condition with a sudden change in the chest, especially in view of the fainting spell during the x-ray examination. I can get nothing from the x-ray examination, however, that makes me change my initial impression from reading the case over. I still believe that there was a rupture of some portion of the gastrointestinal tract, presumably below the pylorus, into the pleural cavity through a congenital lesion in the diaphragm. Whether the patient also had an ulcer, I do not know. There is no evidence one way or the other.

I am doubtful about the coronary thrombosis and I do not believe that evidence of an old coronary occlusion was found. The patient presumably died of sepsis in the pleural cavity — a rather unusual type of empyema — and possibly cardiac collapse, which was not due, however, to any specific heart disease.

DR. HELEN PITTMAN: If there was rupture of a hollow viscus into the pleural cavity, how about air in the pleural cavity? The x-ray films do not appear to show such a finding.

DR. ROBBINS: Air is not necessarily present. For example, a perforation of a peptic ulcer of the esophagus shows little air in the pleural cavity.

DR. BREED: I am not interested in the diverticulum of the esophagus. I should like to add that I do not believe the patient had cancer of the stomach or of the lower end of the esophagus.

DR. MARIAN ROPES: We were impressed with the story of ulcer symptoms for the ten years before entry and did think at first that the hemorrhage came from the ulcer and that the ulcer had perforated into the abdomen. But it soon became apparent that that was not true. We did not properly connect the findings in the left pleural cavity with the process in the gastrointestinal tract.

CLINICAL DIAGNOSES

Bleeding peptic ulcer.
Empyema, left.
Coronary thrombosis, old.

DR. BREED'S DIAGNOSES

Empyema, due to perforation of gastrointestinal tract (presumably below the pylorus).
Diaphragmatic hernia.

ANATOMICAL DIAGNOSES

Peptic ulcer of esophagus, with perforation into left pleural cavity.
Empyema, left.
Myocardial infarct, old.
Diverticulosis of duodenum, jejunum and sigmoid.

PATHOLOGICAL DISCUSSION

DR. CASTLEMAN: The autopsy showed an empyema in the left pleural cavity composed of 600 cc. of turbid, somewhat hemorrhagic fluid. The abdomen was negative. We were unable to find anything in the stomach or duodenum to account for the long-standing ulcer symptoms. At first we were at a loss to explain the cause of the empyema; then Dr. Sniffen found a good-sized hole at the lower end of the esophagus. There was a peptic ulcer of the lower end of the esophagus that accounted for the long-standing ulcer symptoms and had perforated into the left pleural cavity. In the mediastinum was an abscess 3 or 4 cm. in diameter.

The patient had evidence of old coronary thrombosis. The left descending branch of the coronary artery was completely occluded, and we found an anterior healed myocardial infarct.

DR. BREED: The diaphragm was intact?

DR. CASTLEMAN: Yes.

DR. ROBBINS: There was no hiatus hernia? Is it not rather rare to find peptic ulcer of the esophagus without hiatus hernia?

DR. CASTLEMAN: I do not know. It is rather difficult at autopsy to be sure of a slight hiatus hernia. If one did exist, it would probably have been reduced at the time of autopsy.

CASE 29522

PRESENTATION OF CASE

A seventy-three-year-old retired lawyer was admitted to the hospital because of weakness and tiredness.

The patient was in good health until about six months before entry, when, while working in his garden, he felt unusually tired and weak. He continued his activities, but at a slower pace, until eight weeks prior to admission, when he felt extremely weak and went to bed, where he stayed except for a daily trip to the bathroom. He had no fever, chills, night sweats or headaches. In the following four weeks he noticed a sore spot near the tip of the sternum on swallowing. At times there was a sensation of pressure on the chest and an occasional dry cough. His appetite became poor but his bowel movements remained the same as before. One month prior to admission, examination by his family physician was entirely negative except for a small right indirect inguinal hernia. The temperature was 101°F., the pulse 100, and the blood pressure 140 systolic, 70 diastolic. The urine was acid, with the slightest possible trace of albumin. The sediment contained a few white cells but no red cells. The hemoglobin was 60 per cent. The patient was placed on sulfadiazine, 1 gm. four times a day. Two days later the family physician thought that there were possible rales at the left base and an enlarged spleen. The temperature was 99.4°F. In the next two days the cough completely disappeared, the temperature became normal, and the pulse was 96. He had received 40 gm. of sulfadiazine, which was then discontinued. He was placed on iron and vitamin B tablets but refused to take them or to see his physician. He remained in bed. The substernal pain persisted. It was described as a steady, nonradiating pain that felt like "fifteen men on a dead man's chest"; it was not relieved by food or change of position but sometimes went away spontaneously. The patient refused all solid foods although he said that they caused no discomfort. A friend, however, stated that "solid foods seemed to catch on the way down." The patient subsisted on liquids and semisolids, taking them at odd hours instead of the usual mealtimes. There was occasional nausea but no vomiting, hematemesis, bloody or tarry stools and no numbness or tingling of the extremities. Two days before admission he developed a fever of 102°F. The next day his physician noticed marked pallor and weight loss since the last visit.

Physical examination on admission showed a well-developed, rather emaciated, extremely pale man in no distress. The skin was pale and dry; the tongue was normal. The mucosa of the posterior part of his mouth was covered in areas by patches of white exudate with no surrounding inflammatory reaction. The teeth were in poor condition. The pharynx was covered with a thin mucinous discharge. The heart and lungs were normal. There was a small right inguinal hernia. Vibration sense was diminished in the legs, but neurologic examination was otherwise normal.

The blood pressure was 126 systolic, 56 diastolic. The temperature was 101.2°F., the pulse 118, and the respirations 24.

Examination of the blood showed a red-cell count of 980,000, with a hemoglobin of 3 gm. per cent. The white-cell count was 1400. Only 86 cells could be seen in the smear. Of these 22 were neutrophils, 28 large lymphocytes, 16 small lymphocytes and 20 monocytes. The red cells were large and well stained. There was some anisocytosis. No reticulocytes were seen. The urine had a pH of 5.5 and a specific gravity of 1.016. There was a + test for albumin. One or two white cells were seen in the sediment. The stools were guaiac negative. A blood Hinton test was negative. The hematocrit was 13 per cent. The mean corpuscular volume was 133 cubic microns, the mean corpuscular hemoglobin 31 micromicrograms, and the mean corpuscular hemoglobin concentration 23 per cent. The nonprotein nitrogen was 23 mg. per 100 cc. Gastric analysis showed no free acid and a combined acidity of 8 units. At the end of thirty minutes the free acid was 5, and the combined acid 25.

X-ray films of the chest showed no definite evidence of consolidation or shift of the mediastinum. A gastrointestinal series revealed no definite abnormality of the esophagus or stomach. There were at least three large diverticulums of the second and third portions of the duodenum. The duodenal cap showed a pressure defect on the superior surface, which was interpreted as being probably of no clinical significance.

From the time of admission the patient had a persistent fever, the rectal temperature reaching 102°F. daily. During this period he coughed continually but raised no sputum. He was placed on iron and liver, without response. On the third hospital day he had two severe shaking chills. The temperature spiked to 103°F., and the respirations rose to 30. There was no chest pain or increased

cough. Examination showed dullness, bronchial breathing, increased spoken and whispered voice, and rales over the left lower lung field. The white-cell count was 700, but no white cells could be found in the smear. He was given intravenously 4 gm. of sulfadiazine in 1000 cc. of 5 per cent dextrose in water and 500 cc. of whole blood. He remained alert. The temperature gradually rose to 104°F., and he died on the fifth hospital day.

Differential Diagnosis

Dr. John W. Norcross*: This patient was a seventy-three-year-old man with progressive anemia, leukopenia and intermittent chest pain of about six months' duration. Before going into a detailed differential I should like to consider a few points in the history.

The initial complaints were fatigue and tiredness, which of course could have been entirely due, and probably were, to the anemia. The patient also complained of pressure on his chest. Any man with severe anemia, particularly a man of seventy-three, is entitled to angina pectoris, and I think that this must be considered as a possible cause of the pain that he had in the chest. But it was not typical angina, since, as later described, it was nonradiating and steady; angina at times, however, can be almost constant. I also want to point out that the patient had a small amount of albuminuria. So far as we know from the history, the hemoglobin was 60 per cent before he received sulfadiazine. Furthermore, the family doctor thought that the spleen was enlarged, but nowhere else is there any mention of this, and we have to assume that numerous physical examinations made on this man after he entered the hospital did not show a palpable spleen. There are many negative factors mentioned later in the history that are of importance. There was no vomiting, hematemesis, bloody or tarry stools or paresthesias. When he entered the hospital there was no distress, emphasizing the intermittency of the chest pain. The note is made that the vibration sense was diminished. We are not told how much, but we must remember that in a man of seventy-three, owing to the probable presence of arteriosclerosis, this observation is of little clinical importance. The fact that no lymph nodes were felt may be significant. The laboratory notes show that he had a severe macrocytic, hypochromic anemia. Later I shall say more about the blood smear, which Dr. Castleman kindly let me have. The patient had free acid in his gastric analysis. I assume that the test meal was used in doing this analysis, since if histamine had been given there probably would have been more than 5 units of free acid present. At any rate he did not have achlorhydria.

I should now like to see the x-ray film of the chest.

Dr. George W. Holmes: I do not see anything definitely wrong in the chest.

Dr. Norcross: Can you see anything in the bones that might be abnormal?

Dr. Holmes: No. The shadow of the right auricle is possibly a little prominent, but it is well within normal limits. For a man of his age he shows surprisingly little evidence of arteriosclerosis. There is no tortuosity of the aorta, and no visible calcification in the wall. The vessels around the root of the lung are large, but perhaps these are of no great importance. These films show some barium in the esophagus, but we shall have to take the word of the man who did the fluoroscopy that there were no varices. I cannot rule them out from this one film. Diverticulums are scattered along the duodenal loop, but unless there was some question of disease in the pancreas, I should not think they had any particular bearing on the case. The distance between the duodenal loop and the diaphragm is rather short, and one might expect the liver to be small rather than large, although that is not a definite finding.

Dr. Norcross: On the film showing the spine do you see anything to make you worry about the bones?

Dr. Holmes: No.

Dr. Norcross: The patient had a persistent fever, cough and apparently a terminal pneumonia. With regard to a detailed differential diagnosis, one condition that must be considered in any man of this age is an overwhelming infection which can cause the blood picture given in the abstract. Miliary tuberculosis likewise can do this. In addition, a worn-out bone marrow could lead to an anemia and leukopenia of this degree. Although it is not so stated in the history, the smear showed a normal number of platelets, an observation that is against a diagnosis of bone-marrow depletion. The duration of six months is also against it. We might even consider the possibility that one of the diverticulums ruptured and caused a localized peritonitis. In a man of this age the signs as well as the symptoms may be extremely confusing and such a patient can have an abscess in the abdomen without much to show for it on physical examination. Here again, I think that this is extremely unlikely, but should be put into a differential diagnosis. Blood loss either extrinsic into the bowel or intrinsic in the form of a hemolytic process seems unlikely. Blood loss would not account for the extreme leukopenia, and there is ample evidence that the patient did

*Physician, Lahey Clinic

not lose blood from the gastrointestinal tract. From a hemolytic point of view, particularly a hemolytic process coming from a drug or toxic chemical of one kind or another, we should have to assume that he had agranulocytosis in addition to a hemolytic anemia to account for this blood picture. Of course hemolysis leading to such a severe anemia would be accompanied by jaundice, which would be visible to the examiner. This apparently was not the case.

Severe pernicious anemia must be considered. The vibratory change is not significant, but it is important that free hydrochloric acid was demonstrated in the gastric analysis. In my opinion, true pernicious anemia does not have even this amount of free acid in the gastric contents. Furthermore, there was no response to liver therapy. I do not know over how long a period he received liver, but he was in the hospital for five days and at least in that time he did not respond, which is strongly against pernicious anemia. Furthermore, the platelets were normal in the smear and certain other changes in the blood were not characteristic of pernicious anemia.

Carcinoma with metastases is a possibility. We do know that one can have widespread metastases in the bone that do not show by x-ray examination. The type of chest pain could come from metastatic disease in the spine, sternum or ribs. The type of change in the blood, however, is usually different, there usually being more of a myeloid, leukemoid picture, which was not present in this case. Agranulocytosis of course does not explain the anemia. Aplastic anemia, or more correctly hypoplastic anemia, does not explain it, because in this disease the platelets are of necessity reduced along with the other elements. Leukemia, lymphoma and Hodgkin's disease could cause this picture, but again we have no evidence of enlarged spleen, liver or nodes, and with what evidence we have, one would have to be brave to make any one of these diagnoses.

There is one condition that I think is more likely — namely, multiple myeloma with widespread bone-marrow involvement that was not sufficiently localized in any one place to show by x-ray study. The type of pain from which he suffered may be said to be characteristic of, or at least completely compatible with, this diagnosis. The remissions of the pain are also typical. Usually patients with multiple myeloma do not have much change in the platelets and may on occasion have just as severe an anemia and leukopenia. The latter is unusual, of course, but this is an unusual case.

In connection with this point, I should like to make some comments on the smear. I might say that I do not agree entirely with the differential given in the history. According to my interpretation, there were 37 per cent neutrophilic cells, 1 per cent being myelocytes. Most of these cells were perfectly satisfactory neutrophils. Forty-eight per cent were lymphocytes, of which only 5 per cent were normal, all the rest being atypical in one or more ways. In addition to these lymphocytes, 12 per cent were characteristic of cells found in patients suffering from multiple myeloma, 2 per cent being typical plasma cells, and 10 per cent so-called "myeloma cells." There were also 3 per cent blast forms. In addition there was rouleaux formation. I do not want to say too much about this, as it was not outstanding, but in areas of the smear that were thin and would not ordinarily have rouleaux formation there was a considerable amount of it.

The weakness, fatigue and various other things are amply explained by this diagnosis. The patient did not have much albumin in the urine. We do not know whether Bence-Jones protein was present. There are many patients with myeloma, however, who have no more albumin than this, and this albumin may have been Bence-Jones protein. The absence of palpable lymph nodes and enlarged spleen is perfectly characteristic. I should obviously like to see some x-ray evidence to help me here, but I do not believe that the lack of it rules out the diagnosis. I should also like to know about the total protein and the sedimentation rate, as well as the findings of a bone marrow biopsy, but I assume they were not done. I believe that this case can fit in with the diagnosis of multiple myeloma, with terminal bronchopneumonia.

Dr. William A. Bishop: I was much puzzled when I was called to see this patient outside the hospital. I obtained a sketchy and not too reliable history. He had a fever, and although I could not find anything definite in the lungs, I went on the hunch that he must have had an upper respiratory infection. The cough was considerably worse than is stated in the record, although it was unproductive. On that basis, I gave him sulfadiazine. He was a peculiar type of person, who really did not want to see me, and I was called only because the people in the house were anxious about him. So I met an unresponsive, resistant patient from whom it was difficult to get a good history. But, as stated in the record, he had had a definite six-month period of feeling tired. When I first saw him he was pale, but not so markedly

as when he entered the hospital. I saw him three times and was told not to come again. They had no telephone, but I finally got a message to him telling him to stop taking the sulfadiazine and to begin the iron, liver and vitamins. Since the temperature had fallen to normal on the third day, cough at that time, and of course the severe anemia was evident.

DR. BENJAMIN CASTLEMAN: Dr. Beckman, would you like to tell us about your impression?

DR. WILLIAM BECKMAN: I did not have charge of this patient. I saw him once with the medical

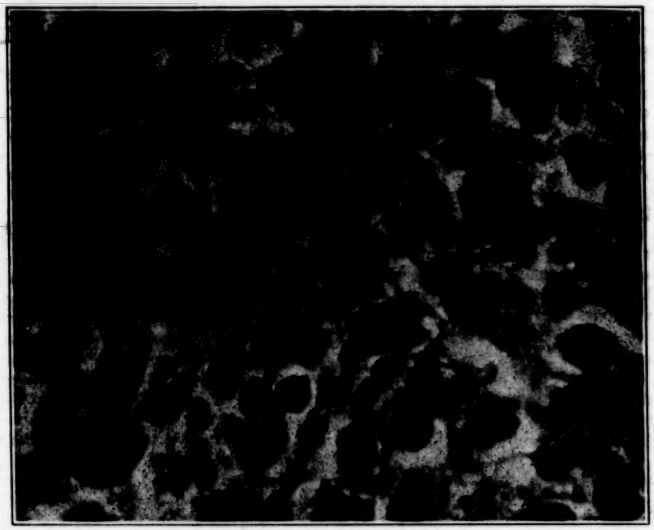

FIGURE 1. *Photomicrograph of the Wall of the Esophagus Showing Plasma-Cell Infiltration.*

I thought that only a day or two more of the sulfonamides was necessary. The thing that he chiefly complained of was pain, or the pressure, as he called it, of "fifteen men on a dead man's chest," at the lower end of the sternum. I do not believe that this was angina, since the pain did not radiate. Then I was struck by the fact that it was painful for him to swallow, and entertained the thought that there might have been something in the esophagus. That was about the picture when I left him, and I was frankly quite at sea. Eight days later I was again called. The temperature was 102°F.; the patient looked worse, being much paler, and had lost weight, with the story that he had continued to refuse food except liquids. He also refused medicine, saying that it hurt him to take it. I thought that I could hear something in the lung bases and sent him to the hospital on the following day with a diagnosis of probable bronchopneumonia. He had fever and students, and I must say that I did not even come close to the diagnosis. I thought that he had aplastic anemia and suggested giving liver in case it were atypical pernicious anemia, with the hope that he might get a response before he succumbed to the obvious pulmonary sepsis that he had at the time.

CLINICAL DIAGNOSES

Aplastic anemia.
Lobar pneumonia: left lower lobe.
Generalized arteriosclerosis.

DR. NORCROSS'S DIAGNOSES

Multiple myeloma.
Terminal bronchopneumonia.

ANATOMICAL DIAGNOSIS

Plasma-cell leukemia, with involvement of bone marrow, spleen, lymph nodes, esophagus, lungs and kidneys.

Pathological Discussion

Dr. Castleman: The autopsy on this man showed an unusual esophagus. Practically the whole esophageal wall, from the beginning to the cardia, was markedly thickened, measuring in places 4 to 5 mm., and was rigid, as if there were submucosal infiltration. It had a dirty, brown-black appearance. On gross examination we were unable to decide what it was. It certainly did not look like carcinoma of the esophagus, and there was no ulceration of the mucosa. The liver was about normal in size, and the spleen slightly enlarged, weighing 290 gm., but neither presented any gross abnormality. The kidneys were slightly enlarged and pale, which one might expect with anemia.

Microscopical examination, however, told the whole story. A section through the wall of the esophagus showed the infiltration that we were able to see in the gross. Practically all the cells were characteristic atypical plasma cells (Fig. 1). In one lymph node, a peripheral sinus was completely filled with plasma cells. Sections of the bone marrow and spleen, as well as those of the lungs and kidney, also showed numerous plasma cells. There were no isolated foci of myelomatous infiltration in the bones, the lesions being diffuse, which, as Dr. Norcross has stated, makes them difficult, if not impossible, to see in x-ray films. We were unable to find any myeloma casts in the tubules of the kidney.

I believe that the case should be classified as plasma-cell leukemia, with diffuse infiltration of the lungs, liver, spleen, kidneys and lymph nodes, as well as the bone marrow, rather than multiple myeloma. Of course the two diseases are the same, but in the leukemic type the plasma cells get out into the peripheral blood in larger numbers than they do in the average case of multiple myeloma. Looking back in our records we found two similar cases — in men sixty-four and sixty-five years old respectively. One had a red-cell count of 1,500,000, and the other a count of 700,000; one had a white-cell count of 1500, and the other a count of 1200. These patients also complained of fatigue and were clinically diagnosed as having aplastic anemia.

Dr. Holmes: Are there any other cases with this type of esophagus?

Dr. Castleman: I cannot recall one, but any kind of leukemia may produce this type of infiltration. Certainly the substernal pain was caused by the esophageal disease.

Dr. Holmes: Under the fluoroscopic examination, the esophagus should have failed to dilate when the patient swallowed. It ought to have been possible to see that the esophagus was rigid. From these films, however, I get the impression that this man was in poor condition and that the examination was incomplete.

Dr. Joseph Aub: Abnormal white cells are more susceptible to sulfonamides than are normal cells. Livingston,* at the Huntington Memorial Hospital, showed that sulfonamides drop the white-cell count enormously in leukemia.

Dr. Castleman: You think that that might also apply to plasma cells?

Dr. Aub: I wonder if it would.

*Livingston, K. E., and Moore, R. D. The reaction of leukemia patients to sulfapyridine administration. *New Eng. J. Med.* 223:975-983, 1940.

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The Journal does not hold itself responsible for statements made by any contributor.

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1944—A YEAR OF DECISION

The year on which we are embarking may well be a year of decision for this generation and for generations to come. With almost no decision on our part we have been forced into a test of power, limitless in its geographic scope; this year, if we are true to our destiny, we shall achieve the first of our final victories. The costs of this victory, and its dangers, are yet to be computed; but whether we shall come through it with a clear future or a confused and clouded one is a decision that soon must be made.

It has become a truism that we can win the war and lose the victory, as we lost it in 1918 and 1919 and in the twenty-odd years thereafter. We are also told that we are fighting and working and paying to preserve our old way of life, and yet we know that many of the fundamentals of that way of life are not worth preserving; if there is anything in this war that is worth winning, besides security, it is a new way of life and a better way of life for all of human kind—and we are not ashamed to say that spiritual and intellectual values must be reckoned ahead of temporal ones.

To many Americans, still, the idea of victory suggests plenty of gasoline, endless rubber and endless roads, and development of the plastic industry to keep pace with the new magic of electronics. These developments will probably come, given peace and prosperity, but there has been a certain fiscal association with the word prosperity, in our past history, that limits its meaning in a rather unfortunate manner.

The real problems that are going to make this a year of decision are those that can be settled only by clear-sighted planning and fact-facing. We are going to begin to be confronted with the necessity of a switch-back of industry to a peacetime basis, with a major unemployment problem. We are going to meet the vanguard of several million young men, crippled and well, who will want to see the rewards of the victory they have won. We are going to decide whether we can continue to play ball with our allies, once the common danger is past, or whether we are going to start a scramble for the major part of the fruits of victory—to see who can dominate the air routes, the shipping lanes and the richest markets. We are going to see if we can play a mature role in world politics and world statesmanship, after the patterns that we have professed—protecting without patronizing, helping without bullying and cooperating without assuming a leadership that has not been earned. This may be the year when we shall have to decide whether, as a nation, we have become of age—if we are mature enough to be granted a leadership in settling the most perplexing problems with which the world has yet been confronted.

THE FATIGUE LABORATORY

The Fatigue Laboratory of the Harvard School of Business Administration was the result, more or less directly, of the wisdom and foresight of Dean Wallace B. Donham who, during his term of office, appreciated the possibilities of research into the conditions with which industry is concerned. The laboratory was accordingly set up, in 1928, under the auspices of the Rockefeller Foundation, and continues to function with the aid of the National Research Council.

The late Professor Lawrence J. Henderson directed the establishment of the laboratory and was its wisest counsellor, under the successive directorships of Dr. Arlie V. Bock and Dr. D. B. Dill. Lieutenant Colonel Dill continues his interest during the present activities of the laboratory but the active directorship has passed back into the hands of Dr. Bock for the duration of the emergency, with the practical functioning of the laboratory in the hands of Drs. R. C. Darling, W. H. Forbes and Robert E. Johnson.

Except for a small flame of pure research that is kept burning at the laboratory until better days for academic pursuits have returned, the work that is being conducted is done entirely for the Office of Scientific Research and Development and for the Quartermaster Corps of the Army. Thus, in the cold room, with a minimum temperature of −40°F., various types of warm clothing, including electrically heated suits and shoes, are tested on the living subject; here also, stiffly recumbent, lies "Oscar," the electric dummy, within whose patient frame is measured the amount of current required to keep his body temperature up to a human normal with the aid of various styles and types of garments. In another chamber, tropical heat and humidity are attained, and here, experiments are conducted on heat exhaustion and acclimatization, and the best types of clothing for these climatic conditions, with a three-and-a-half-mile-an-hour march simulated on an electric treadmill. Still another chamber furnishes the atmospheric pressures of various altitudes.

Nutrition studies based on the standard field rations are being conducted, with a view to their balance, particularly regarding the vitamin B fractions; studies have been made under field working conditions on the protein requirements of the body, and it has been found that good health and nutrition can be maintained on a protein intake considerably below the traditionally accepted 70 gm. per day, with those that are provided being principally from vegetable sources.

In addition to its homework, the laboratory is constantly on call to send its investigators into the field wherever needed, to make their studies under actual living and working conditions. Its official reports run into volumes, and when, finally, the veil of secrecy can be lifted, it will be found that scientific progress has taken some tremendous steps in various directions during the war years.

Indefinite and inclusive as the term "fatigue" may be, the Fatigue Laboratory has long since outgrown its title.

MEDICAL EPONYM

Pandy Reaction

The paper "Über eine neue Eiweissprobe für die Cerebrospinalflüssigkeit [A New Albumin Test for the Cerebrospinal Fluid]" by Kalman Pandy (b. 1868) appears in the *Neurologisches Centralblatt* (29: 915–919, 1910). A portion of the translation follows:

> This test consists in adding a drop of cerebrospinal fluid to about 1 cc. of concentrated carbolic acid (1 part carbolic acid crystals plus 15 parts of distilled water). Wherever the two fluids come in mutual contact there appears after a few seconds a bluish white turbidity resembling a cloud of smoke — an indication that in the fluid in question there are easily precipitable proteins (globulins) in pathological quantity.

R. W. B.

CORRESPONDENCE

A WARTIME EMERGENCY DIABETIC COMA SERVICE

To the Editor: Early diagnosis and prompt treatment of diabetic coma lessen mortality and shorten the period of recovery. With this in mind, the Emergency Diabetic Coma Service has been created at the New England Deaconess Hospital.

Through the co-operation of the hospital, a corps of diabetic nurses, a chemical technician and the medical staff, blood and urine analyses, as well as medical treatment and special nursing, will always be available, day and night, Sundays and holidays. Such a service would be desirable for all hospitals, but unfortunately on account of war conditions this is not feasible.

Any doctor who has a case of diabetic coma in or outside a hospital and cannot secure the laboratory and medical assistance that he believes indicated can feel at liberty to call on the Emergency Diabetic Coma Service at the New England Deaconess Hospital for consultation regarding treatment or admission of the patient.

WARREN F. COOK
ELLIOTT P. JOSLIN, M.D.

New England Deaconess Hospital
Deaconess Road
Boston

DEPRIVATION OF LICENSE

To the Editor: At a meeting of the Board of Registration in Medicine held November 19, the Board voted to revoke the license to practice medicine in this Commonwealth of Dr. Aaron O. Bernstein, 634 Page Boulevard, Springfield, and formerly of Gardner and Winchendon, because of gross professional misconduct in the practice of his profession.

H. QUIMBY GALLUPE, M.D., *Secretary*
Board of Registration in Medicine

State House
Boston

BOOK REVIEWS

Biological Symposia. Edited by Jaques Cattell. Volume VIII. *Levels of Integration in Biological and Social Systems.* Edited by Robert Redfield. 4°, cloth, 240 pp. Lancaster, Pennsylvania: The Jaques Cattell Press, 1942. $2.50.

The contributions to this interesting volume represent new frontiers of research for students of human society. The papers are all concerned with one or another aspect of the question, How are parts constituted into wholes throughout the range of life-forms?

An informative and critical introduction is written by Robert Redfield. Libbie H. Hyman, in "The Transition from the Unicellular to the Multicellular Individual," points out that the essential difference between a protozoan colony and a multicellular individual is polarization, the establishment of an axis along which there is both functional and morphological differentiation. "Intermediate Levels of Organismic Integration," by J. William Buchanan, sums up his position in the declaration that the organization of animals of the lower groups is characterized by an absence of centralization of the response mechanisms. In the chapter "Higher Levels of Integration" R. W. Gerard notes that the difference between lower and higher organisms is mainly in their transmissive mechanisms and in their adaptive amplification. Man as an org is selfish, individualistic and dominated by the old brain and its emotional attributes. Man as a unit in the epiorganism is altruistic and cooperative, and depends on the functioning of his new brain and its intellectual attributes. William Burrows, in his paper "Synergistic Aspects of Bacterial Populations," questions the validity of the concept that specific microbic etiology is the basis of much of modern bacteriology and suggests that diseases may be caused not by a single species of bacterium but by associated micro-organisms. H. S. Jennings concludes that the transition from the individual to the social level begins in the *one-cell* organisms; and advances there by several steps. Thomas Park considers the problem of integration in infrasocial insect populations, with marked emphasis on the argument that population is as much a biologic unit as the organism and has the attributes of preproduction, death, metabolism, irritability, growth and differentiation, a heredity, and environmental adaptation and adjustment. The chapter by W. C. Allee, entitled "Social Dominance and Subordination Among Vertebrates," points to the fact that the dominance-subordination social pattern may be based on heredity, the physiologic state of the individual and psychologic factors. A closer reciprocal understanding between the social and the biologic sciences is urged by Dr. Alfred E. Emerson in his chapter "Basic Comparisons of Human and Insect Societies," to the end that scientists shall not overlook the place of emotional force and harmony even in science. C. R. Carpenter gives an interesting and illuminating discussion on societies of monkeys and apes. In "The Societies of Primitive Man," A. L. Kroeber attempts to show that some measure of kinship of primitive man persists into higher civilization because kinship is biologically inescapable and perhaps equally inescapable psychologically. The concluding chapter, "Modern Society," is by Dr. Robert E. Park, who discusses the "great society" from the distinguishing characteristics of size, complexity, speed, mechanism and freedom.

It seems to the reviewer that a careful reading of this instructive volume will give the reader a fair measure of intellectual balance in any further consideration of biologic phenomena.

Starling's Principles of Human Physiology. Edited and revised by C. Lovatt Evans, D.Sc., F.R.C.P., F.R.S., LL.D. With chapters on the special senses revised by H. Hartridge, M.D., Sc.D., F.R.S. Eighth edition. 8°, cloth, 1247 pp., with 673 illustrations. Philadelphia: Lea and Febiger, 1941. $10.00.

The author succeeds well in maintaining a proper balance in presenting the subject matter of physiology in its more important recent developments. The order adopted is in keeping with the courses given at University College. In this edition, the section covering the central nervous system has been entirely rewritten to conform to the newer knowledge in this field. The chapter on reproduction has been extensively revised, and a good deal of new matter has been added. The discussions on the endocrine organs, the vitamins and the urinary system and those sections concerned with biochemistry have been rewritten and rearranged. One will find many newly introduced figures of great teaching value. Although the book is essentially planned for the use of the student, the clinician can turn to it with considerable profit.

BOOKS RECEIVED

The receipt of the following books is acknowledged, and this listing must be regarded as a sufficient return for the courtesy of the sender. Books that appear to be of particular interest will be reviewed as space permits. Additional information in regard to all listed books will be gladly furnished on request.

Miracles of Military Medicine. By Albert Q. Maisel. 8°, cloth, 373 pp. New York: Duell, Sloan and Pearce, Incorporated, 1943. $2.75.

This popular book on military medicine and surgery is well written in an interesting dramatic style and furnishes a summary of the new developments in treatment that are consistently reducing camp and field mortality in World War II. The subjects treated include shock, the Trueta treatment of open wounds, detection of foreign bodies by the Moorhead locator, burns, plastic surgery, tetanus control and prevention, brain surgery, malaria, chest surgery, sulfa drugs and local anesthesia. The concluding chapters describe the activities of the flight surgeon and flying doctors, the medical organization of the army and postwar problems. This book is recommended for all medical and public libraries. It can be read with profit by all physicians.

American Standard Definitions of Electrical Terms. 4°, cloth, 311 pp. New York: American Institute of Electrical Engineers, 1943. $1.00.

This authoritative reference work was compiled by a special committee representing thirty-three organizations in the electrical field and organized by the American Institute of Electrical Engineers. The committee was enlarged by the appointment of eighteen subcommittees with a total membership of one hundred and twenty, to which were added numerous nonmember experts, so that, in all, over three hundred authorities in all fields aided in the compilation. The primary aim of this glossary is to express for each term the meaning that is generally associated with it in electrical engineering in the United States. The preferred definition is a simple one, with a single statement of function rather than explicit description of all properties included and excluded. The arrangement is by special groups and subsidiary sections. The numbering used to identify terms is based on a system proposed for use by the International Electrotechnical Commission. Groups 75 and 80, having to do with radiology and electrobiology, including electrotherapeutics, are of medical interest. There is an extensive, comprehensive index. The work is well arranged and well printed on good paper in a good binding and sold at a nominal price. It should be in all medical libraries, as well as in the offices of all physicians interested in radiology and electrotherapeutics.

Injuries of the Skull, Brain and Spinal Cord: Neuropsychiatric, surgical, and medico-legal aspects. Edited by Samuel Brock, M.D. Second edition. 8°, cloth, 616 pp., with 78 illustrations. Baltimore: The Williams and Wilkins Company, 1943. $7.00.

This second edition has been revised to date by the inclusion of important changes in the fields of sulfonamide and electroencephalography and the newer advances in military surgery. The most important addition to the book is the chapter on electroencephalography in cases of head injury. It is based on thorough analyses of a large number of patients studied at the Neurological Institute of New York.

Pictorial Handbook of Fracture Treatment. By Edward L. Compere, M.D., associate professor of surgery, Northwestern University Medical School, chairman, Department of Orthopedic Surgery, Wesley Memorial Hospital, and consulting orthopedic surgeon, Chicago Memorial Hospital; and Sam W. Banks, M.D., associate in surgery, Northwestern University Medical School, and attending orthopedic surgeon, Chicago Memorial Hospital. 8°, cloth, 351 pp., with 171 illustrations. Chicago: The Year Book Publishers, Incorporated, 1943. $4.25.

This work has been prepared for the overworked country doctors and general practitioners who are so situated that they are unable to obtain the advice of specialists.

Handbook of Health for Overseas Service. By George C. Shattuck, M.D., and W. Jason Mixter, M.D. Second edition, revised. 24°, cloth, 228 pp., with 15 illustrations. Cambridge: Harvard University Press, 1943. $1.25.

This second edition has been intensively revised and in part rewritten. The handbook is intended for use by persons who are engaged in dangerous work overseas and who may be unable to obtain medical advice or assistance. In order to prevent the possibility of harm resulting in the use of the handbook in the United States where medical aid is available, sales will be restricted, ordinarily, to persons or groups who are going overseas. Water-resistant ink and paper have been used in the printing, and the weight of the volume has not been increased because the paper used is slightly thinner.

Allergy. By Erich Urbach, M.D., chief of the Allergy Service, Jewish Hospital, Philadelphia, and associate in dermatology, University of Pennsylvania School of Medicine. With the collaboration of Philip M. Gottlieb, M.D., associate on the Allergy Service, Jewish Hospital, Philadelphia, and instructor in medicine, University of Pennsylvania School of Medicine. 4°, cloth, 1073 pp., with 395 illustrations and 59 tables. New York: Grune and Stratton, 1943. $12.00.

This new work is a comprehensive treatise on its subject and is designed for the purpose of serving as a guide in the diagnosis and management of the diseases of hypersensitiveness. Voluminous literature on this subject has been consulted, and a great many references are appended in the form of footnotes to the text.

Studies from the Rockefeller Institute for Medical Research. Reprints: Volume 123. 8°, cloth, 619 pp., illustrated. New York: The Rockefeller Institute for Medical Research, 1943.

Virus Diseases. By members of the Rockefeller Institute for Medical Research. 8°, cloth, 170 pp., with 11 illustrations and 2 plates. Ithaca, New York: Cornell University Press, 1943. $2.00.

This monograph consists of six lectures by different authors that were delivered at Cornell University in the spring of 1942 as the Messenger Lectures, covering the evolution of civilization.

Air-Borne Injection: Some observations on its decline. By Dwight O'Hara, M.D., professor of preventive medicine, Tufts College Medical School, visiting physician,

Boston City Hospital, and physician-in-chief, Waltham Hospital. 8°, cloth, 114 pp., with 11 charts. New York: The Commonwealth Fund, 1943. $1.50.

This small work discusses the spectacular reduction in mortality due to some of the common diseases and seeks to ascertain the underlying causes of this decline.

Diagnosis of Uterine Cancer by the Vaginal Smear. By George N. Papanicolaou, M.D., Ph.D., Department of Anatomy, Cornell University Medical College; and Herbert F. Traut, M.D., Department of Obstetrics and Gynecology, Cornell University Medical College and the New York Hospital. 4°, cloth, 46 pp., with 11 color plates. New York: The Commonwealth Fund, 1943. $5.00.

This volume describes a new, simple and inexpensive aid in the diagnosis of cancer of the uterus. The study is based on three years' experience in the Woman's Clinic at Cornell University.

Clinical Parasitology. By Charles F. Craig, M.D., M.A. (hon.), colonel, United States Army (retired); and Ernest C. Faust, M.A., Ph.D., professor of parasitology, Department of Tropical Medicine, Tulane University of Louisiana, consultant on tropical medicine and on epidemic diseases to the Secretary of War and to the United States Public Health Service. 8°, cloth, 767 pp., with 284 illustrations and 4 colored plates. Philadelphia: Lea and Febiger, 1943. $9.00.

This new edition of a standard work has been brought up to date and new material relating to epidemiology in the field of human parasitology and on diseases transmitted to man by arthropods has been included. Four full-page color plates, two clinical tables and forty new figures have been added to the text. The table on the important malaria-transmitting mosquitoes of the world has been revised by Lt. Col. Paul F. Russell, Division of Preventive Medicine, Office of the Surgeon-General, Army of the United States. This work should prove valuable to medical and sanitary officers stationed in the tropics and the Orient.

Nutrition in Health and Disease. By Lena F. Cooper, B.S., M.A., M.H.E., chief, Department of Nutrition, Montefiore Hospital, New York City, dean, School of Home Economics, Battle Creek College, and supervising dietitian, United States Army (1918–1919); Edith M. Barber, B.S., M.S., editor of food column, New York *Sun*, and lecturer on history of cookery, Teachers College, Columbia University; and Helen S. Mitchell, B.A., Ph.D., chief nutritionist, Office of Foreign Relief and Rehabilitation Operations, State Department, and research professor in nutrition, Massachusetts State College. Ninth edition, revised. 8°, cloth, 716 pp., with 99 illustrations and 7 colored plates. Philadelphia: J. B. Lippincott Company, 1943. $3.50.

This standard work on nutrition for use in schools of nursing has been thoroughly revised and brought up to date. Much new material has been added on the vitamins and a new chapter on food and nutrition problems in wartime. The table on the composition of foods has been revised and includes niacin, pyridoxine, pantothenic acid and biotin. A new feature of this edition is a glossary giving the concise definition of technical words and their pronunciation.

Gastro-Enterology. By Henry L. Bockus, M.D., professor of gastroenterology, University of Pennsylvania Graduate School of Medicine. Volume 1. *The esophagus and stomach.* 4°, cloth, 831 pp., with 134 illustrations and 21 tables. Philadelphia and London: W. B. Saunders Company, 1943. $12.00.

This is the first volume of a system of diseases of the digestive tract and organs. The second volume, covering the small and large intestines, and the third volume, covering the liver, biliary tract, pancreas and secondary gastrointestinal disorders, will be published later. The purpose of the work is to include a discussion of every disease and affection of the digestive tract. The author has drawn on his large experience in the Gastrointestinal Clinic of the Graduate Hospital of the University of Pennsylvania.

The Modern Treatment of Syphilis. By Joseph E. Moore, M.D., associate professor of medicine and adjunct professor of public-health administration, Johns Hopkins University, physician-in-charge, Syphilis Division, Medical Clinic, and visiting physician, Johns Hopkins Hospital, Baltimore, and special consultant, United States Public Health Service. With the collaboration of Jarold E. Kemp, M.D.; Harry Eagle, M.D., surgeon, United States Public Health Service, and lecturer in medicine, Johns Hopkins University; Paul Paget, M.D., associate in medicine, Johns Hopkins University; Mary S. Goodwin, M.D., instructor in pediatrics, Johns Hopkins University; and Frank W. Reynolds, M.D., instructor in medicine, Johns Hopkins University. Second edition; second printing. 4°, cloth, 717 pp., with 109 illustrations and 126 tables. Springfield, Illinois. Charles C Thomas, 1943. $7.00.

This authoritative work was first published in 1933, and the second edition in 1941. The second edition was completely revised to the extent that twenty-three of the original thirty-two chapters of the first edition were completely rewritten and the other nine chapters were extensively changed. The entire second edition was reset from new type. A new chapter on the public-health aspects of the treatment of syphilis and a much needed discussion of infections in syphilis and its relation to treatment have been added. The bibliography has been kept at about the same length as that in the first edition by the omission of older references to make room for the many more recent ones. The second printing of the second edition has made possible the inclusion of a new chapter on venereal-disease control in the Army and Navy; in addition, the chapter on intensive arsenotherapy of early syphilis has been thoroughly rewritten and brought up to date.

The Boy Sex Offender and His Later Career. By Lewis J. Doshay, M.D., Ph.D., psychiatrist, Children's Courts, New York City. With a foreword by George W. Henry, M.D., associate professor of clinical psychiatry, Cornell University Medical College, consulting psychiatrist, Department of Correction, New York City, and attending psychiatrist, New York Hospital. 8°, cloth, 206 pp., with 40 tables. New York: Grune and Stratton, 1943. $3.50.

The author of this book has worked for over a period of ten years examining and treating thousands of boys in the clinics of the Children's Courts of New York City. His comments and conclusions are therefore based on a relatively large number of cases. His investigations shed new lights on certain phases of juvenile sex delinquency. A rather startling conclusion is that the so-called good boys commit just as many a violent offense as the confirmed delinquents.

(Books Received continued on page lxi)

229
43